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IMPLEMENTATION AND EVALUATION OF THE TANK CREW TRAINING PROGRAM FOR USAREUR UNITS

by

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A previously-developed Tank Crew Gunnery Training Program for USAREUR units was tried out in a USAREUR armor battalion four weeks prior to tank gunnery qualification firing at the Baumholder Training Area. Tank crews in the test battalion trained exclusively on the prototype program. A second battalion, selected for comparison purposes, was trained "conventionally" by following their established training program. The training for both battalions was closely monitored. Both battalions later performed on Tank

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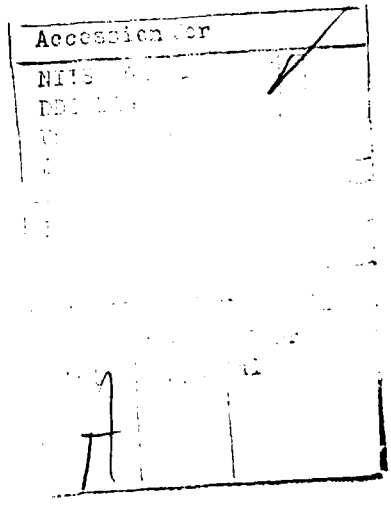
20. Abstract

Crew Gunnery Table VI at Baumholder, and performance dated were collected.

The prototype program was successfully implemented, requiring only minor modifications. Training on the prototype program was found to be as effective as conventional training in terms of meeting the Baumholder Training Area performance standards on Table VI.

FOREWORD

Research in the area of simulation-based training program development and field validation is a major effort of the Army Research Institute (USAREUR) Field Unit. The entire project is directly responsive to the Army's advanced development RDTE program and to special requirements of the 7th Army Training Command at Grafenwoehr, Germany. The present effort, accomplished under Contract No. DA 903-78-C-2042 documents the findings of an initial tryout and evaluation of a prototype simulation-based tank crew training program, developed under previous ARI tank gunnery research. During this phase of the research effort the prototype crew training program was implemented in a USAREUR battalion and an evaluation of its effectiveness was carried out. The results of that evaluation are contained in this report.



Implementation and Evaluation of the Tank Crew Training Program for USAREUR Units

BRIEF

REQUIREMENTS

A Prototype Tank Crew Gunnery Training Program was previously developed for USAREUR units with limited training resources. The program is performance oriented, and simulation-based and is designed to train the skills required for tank crew qualification, and to maintain these skills on a continuous basis. The purpose of the work reported here was to try out this training program in an operational setting to determine if the program design criteria could be met and to evaluate its training effectiveness.

PROCEDURE

The tank crew training program was implemented in a USAREUR battalion four weeks prior to tank gunnery criterion firing at the Baumholder training Area (BTA). All tank crews in the battalion trained exclusively on the tasks, conditions, and standards of the prototype training program. A second battalion, with somewhat greater training resources, was selected for comparison purposes and this battalion trained "conventionally," that is following their established training program. The training of both battalions was monitored and the kind and amount of training actually conducted was recorded.

Training program effectiveness was assessed for both groups based on their crew gunnery performance on gunnery Table VI at Baumholder training area. Data were collected on firing times and accuracy and these were compared against the criterion performance standards for the table. Additional performance data were also collected for the Multiple Tank and Platoon Gunnery Firing Tables.

FINDINGS

The prototype tank crew training program was successfully implemented and only minor modifications were required in the program design and procedures. Training on the prototype program was as effective as training conventionally in terms of meeting the BTA performance standards on Table VI; however both groups met standards on only one third of the engagements on the table. The conventionally trained group performed better on the Platoon Gunnery Table and this may have been due to the fact that their training program contained platoon level training elements. There was no identified relationship between past experience and performance on the criterion measures.

A need exists to develop reliable tank gunnery criterion performance standards and measurement techniques. Additionally individual techniques and devices contained in the training program need to be evaluated to assess their relative effect on total system effectiveness.

UTILIZATION OF FINDINGS

The Tank Crew Gunnery Training Program has utility as a crew training program for USAREUR units operating in a training environment with limited resources. Work presently in progress will add a platoon level training segment to the program to form an integrated training program to develop and maintain both crew and platoon level gunnery skills.

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IMPLEMENTATION AND EVALUATION OF THE TANK CREW TRAINING PROGRAM FOR USAREUR UNITS

INTRODUCTION

Tank gunnery training in USAREUR has traditionally followed the program outlined in FM 17-12 and supplementary tank gunnery manuals. A major portion of this training program is designed around nine gunnery firing tables which are used to train and test tank crews and platoons on the various skills necessary to acquire, engage, and destroy threat targets. Gunnery Tables I, II, and III focus on the gunner and tank commander and develop prerequisite gunnery skills. Tables IV, V, VI, VII, and VIII involve the tank crew and emphasize teamwork in acquiring and engaging targets. Tables VP and IX are platoon level exercises which emphasize control and distribution of platoon fires. The culmination of crew level training is Table VIII, a live fire qualification course, which requires the crew demonstrate their gunnery proficiency against specified gunnery standards. Typically, tank crews train on gunnery Tables I through VP in garrison or their local training areas (LTA). They then move to a major training area (MTA) where they can fire main gun ammunition for Tables VI through IX. Crews are normally required to qualify on Table VIII on an annual or semi-annual basis at the MTA.

Over the last several years a number of problems relating to tank crew gunnery training have been recognized. First, the "lock-step" training application on Table I through IX may not be adequate to develop the skills and knowledges required for tank crew gunnery proficiency. Second, many units do not have adequate facilities and support to train on preliminary tables at local training areas. Thus such training is actually squeezed into the time available at MTAs. Third, since training and qualification firing at MTAs is limited, at best, to a semi-annual visit, there is a serious problem of proficiency maintenance throughout the year. Finally, traditional tables are not necessarily designed to train for meeting a numerically superior ground threat as defined in current threat doctrine.

In response to these problems, tank gunnery training in USAREUR is undergoing some scrutiny and change. Change is most evident in the armor units of the 8th Infantry Division. This Division has revised the FM 17-12 gunnery tables to reflect more emphasis on multiple targets and simultaneous target engagements. In addition, the Division is moving away from the concept of requiring crew qualifications (Table VIII) and instead is making the platoon battle run (Table IX) the final criterion for gunnery performance. The preliminary live fire tables are used as "enabling training" for Table IX Qualification. Finally, the Division is attempting to institute a quarterly gunnery qualification program which is geared toward maintaining gunnery and tactical skills at a consistently high level.

On a more fundamental level, the Army Research Institute Field Unit in Heidelberg has initiated a research program aimed at meeting the training needs implied by the problems and changes mentioned above. The goals of this research program are:

1. To develop performance oriented tank gunnery training programs at the crew and platoon level in which instructional objectives guide the practice of component tasks until performance standards are acheived.

2. To design the programs so they can be conducted entirely at local training areas with limited resources to achieve and maintain readiness on a two month training cycle.

3. To design the programs so they have both an evaluation and diagnostic capability which provides continuous feedback on training needs and readiness status.

The first step in the program focused on tank crew gunnery skills as characterized by Table VIII gunnery qualifications. A task analysis of crew functions with respect to the USAREUR Table VIII at Grafenwoehr was conducted which identified critical skills, subtasks, and functions.[1] As a result of this analysis, a simulation based performance oriented tank crew training program was designed.[2] In the current phase of the research effort the prototype training progra... was implemented in a USAREUR unit and an evaluation of its effectiveness was conducted. This report describes the results of the implementation and evaluation.

SCOPE

The training program implementation and evaluation presented in this paper was conducted with armor battalions of the 8th Infantry Division. The criterion gunnery evaluations were conducted at the Baumholder tank ranges and reflect the training requirements and standards presently in effect for 8th ID armor units.

Gunnery Table VI was used as the criterion test for the prototype crew training program. At Baumholder, Table VI is a crew live fire gunnery table which includes many of the exercises contained in the conventional Table VIII but emphasizes multiple targets and simultaneous engagements. The main functional difference in the 8th ID Table VI is that it requires a stationary firing platform as opposed to the moving tank in the traditional Table VIII Crew Qualification Battle Run. Although the prototype crew training program

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[1]Miller, Elmo E., and Hayes, John F., "Analysis of Tank Crew Duties for Multiple Target Engagements," Research Memorandum. Army Research Institute, Arlington, Va., 1977.

[2]Miller, Elmo E., "Tank Crew Training Program Outline for USAREUR Units." Technical Report TR 77-A15, Army Research Institute, Alexandria, Va., December 1977.

was modeled on a conventional Table VIII, its primary characteristic is that it provides for "training to standards" on basic skills and knowledge which are applicable to various crew gunnery performance criteria. Therefore only minor modifications were required in the program to adapt it to the Table VI criterion evaluation.

Finally, the scope of the present effort covered only one training cycle. Therefore no assessment of the program's effectiveness for proficiency maintenance was possible.

OBJECTIVES

The overall purpose of the work reported here was to try out the prototype tank crew training program in an operational setting to determine if the program design criteria could be met and to evaluate its training effectiveness. The specific objectives were:

1. To implement a simulation based tank crew training program at a USAREUR local training area to determine operational requirements and constraints. To modify training methods, procedures, and standards as necessary to meet training program objectives and constraints.

2. To compare the effectiveness of the simulation training program to conventional training in terms of crew gunnery proficiency on Gunnery Table VI.

3. To assess the relative performance of the two training groups on live fire multiple tank and tank platoon gunnery tables.

4. To determine, to the extent possible, the correlation of various simulation training program elements with total criterion performance scores on Table VI.

5. To assess the opinions of training participants concerning the relative effectiveness and validity of the training programs.

APPROACH

Two armor battalions in the 8th Infantry Division participated in the study. The battalions were selected because of their availability for participation in the project and also because of certain similarities and differences which were relevant to the study design. The similarities were that both battalions had completed Level I Gunnery at Grafenwoehr approximately five months prior to the beginning of the study. Both battalions were also scheduled for gunnery qualifications at Baumholder approximately four weeks after the study start date. In terms of differences, one battalion designated hereafter as the Experimental Group, operates in a very

constrained environment at their home station having very limited terrain and resources to conduct tank crew training. The second battalion, designated as the Comparison Group, has more extensive facilities and resources at their LTA and also conducts a well established and continuous program of tank crew gunnery training.

At the outset of the study available data was assembled to assess the relative baseline gunnery proficiency of the two groups. These data consisted of gunnery scores from their last Table VIII qualifications at Grafenwoehr. During the training period itself the Experimental Group trained exclusively on the prototype tank crew training program while the Comparison Group trained "conventionally," that is, they followed their established training program. Research personnel monitored the training of both groups. For the Experimental Group researchers insured, to the extent possible, that training guidelines were being followed. They also collected training results data. For the Comparison Group, data were collected on the amount and type of training that was conducted. A brief biographical and opinion questionnaire was administered to both groups following training.

Training program effectiveness was assessed for both groups based on their crew gunnery performance on Table VI at Baumholder. In addition to Table VI scores, performance data were also collected on Table VIII (designed as a Multiple Tank Battle Run at Baumholder) and Table IX (Platoon Battle Run).

METHOD

TANK CREW TRAINING PROGRAM OVERVIEW

The Prototype Tank Crew Training Program is described in detail in Appendix A which also includes a description of the implementation procedures and "lessons learned." This section discusses some of the characteristics of the prototype program and how they relate to the conventional tank crew gunnery training approach. An outline of the component tasks in the program is also presented.

Conventional tank gunnery training follows a program prescribed in FM 17-12, the Tank Gunnery Manual. In outline form, this program requires that all crew members train and qualify on the Tank Crew Gunnery Skills Test (TCGST) prior to crew training. Crew training then consists of performing the exercises in Tables I through VI of the gunnery program. Following this training, crews are required to qualify on Table VIII, the Tank Combat Course and Table IX, the Platoon Battle Run.

The overall program is characterized by a "lock-step" approach, that is, training proceeds from simple tasks to more complex tasks independently of individual or crew evaluations of proficiency at intermediate levels. In addition, the training exercises themselves are structured according to tactical scenarios rather than being based on the acquisition of

relevant functional skills. For example, the tasks in the tables present various permutations of such variables as stationary tank vs. moving tank, stationary target vs. moving target, etc. What is not addressed are the component perceptual, motor, cognitive or decisions skills which should be developed to achieve gunnery proficiency. The problem inherent in this kind of training approach is that; (a) there are no set standards which can be used to evaluate performance at various levels and determine if additional training on certain tasks is required, and (b) since component functions are not scored separately but rather confounded in overall task performance, it is impossible to perform a diagnostic evaluation of a task to determine which functional elements need additional emphasis.

The simulation based Tank Crew Training Program attempts to provide a solution for these two problems. First, all of the training tasks and subtasks are defined in terms of performance objectives; that is, in terms of the task, conditions, and performance standards. Second, tasks are provided which address both the tactical scenarios required in the gunnery tables, and the component skills and knowledges which are basic functional components of gunnery. Therefore the capability exists for evaluation of all tasks against standards, and the diagnosis of performance shortcomings in terms of functional task components.

The activities in the Prototype Training Program are clustered at six stations for convenience of administration. The component tasks at each station are as follows:

Station 1. Paper and pencil test (gunner and tank commander, or TC)

- Task 1. Estimate lead for moving targets
- Task 2. Use adjustment of fire techniques

Station 2. Stationary tank (gunner and TC)

- Task 1. Aim main gun at stationary tank targets
- Task 2. Track and fire on moving targets
- Task 3. Apply range card data

Station 3. Full scale range, non firing (all crew members)

- Task 1. Detect targets and record location (all crew members)
- Task 2. TC: Lay main gun (approximately)
- Task 3. TC: Determine range to targets with rangefinder

Station 4. Subcaliber range, 1/60 scale (gunner and TC)

Day

- Task 1. Engage multiple machine gun targets with coax and cal. 50
- Task 2. Engage multiple moving tank targets with main gun
- Task 3. Engage multiple tank targets with main gun and one BRDM with cal. 50

Night

Task 1. Engage stationary tank target using range card to direct lay technique (searchlight illumination)
Task 2. Engage stationary tank target using range card to direct lay technique (IR illumination)
Task 3. Engage multiple machine gun targets with coax and cal. 50 (searchlight)
Task 4. Engage multiple moving targets with main gun (searchlight)

Station 5. Moving tank (all crew members)

Task 1. Load main gun five times
Task 2. Apply immediate action to reduce misfire in main gun
Task 3. Apply immediate action, cal. 50
Task 4. Apply immediate action, coax
Task 5. Driver: Respond to tactical commands

Station 6. Moving tank range 1/20 scale (all crew members)

Tasks - Repeat Station 4 engagements on largest scale range available.

RESEARCH PARTICIPANTS

Research participants consisted of the tank crews from two armor battalions, 8th Infantry Division, USAREUR. Including headquarter's tanks a company could number from 15 to 18 tank crews, thus a battalion can consist of a total of 48 tanks. Both battalions trained with "fifth crewmen," an extra man, usually trained as a driver or loader, who could assume this position if one of the regular crewmen was missing. Crews were stabilized at the beginning of the study to minimize crew turbulence; therefore the fifth crewman was actually used in very few instances during criterion firing.

Since crews could not be randomly assigned to the Experimental and Comparison Groups it is important to know the relative background characteristics of the two groups both in terms of job experience and baseline gunnery proficiency. Table 1 summarizes the background descriptive characteristics of both groups. Looking at the experience measures averaged over duty positions shows that the groups are very similar on all variables identified. The groups are dissimilar however in terms of tank commander and gunner experience on certain measures. Tank commanders in the Comparison Group, on the average, have served longer in this duty position and also have longer service in M60 tanks. A greater percentage of tank commanders and gunners in the Experimental Group had never fired Table VIII Gunnery. In terms of how long tank commanders and gunners have served together there is a slight edge for the Experimental Group. There are also some differences between groups in loader and driver experience; however, these are probably less critical in terms of their effect on gunnery performance on Table VI.

TABLE 1

DESCRIPTIVE CHARACTERISTICS OF TANK CREWS IN EXPERIMENTAL AND COMPARISON GROUPS BY CREW POSITIONS

	Duty Position	N[1]	Grade (MEDIAN)	Months in Present Crew MEAN	Months in Present Crew S.D.	Months in Present Duty Position MEAN	Months in Present Duty Position S.D.	Months in M60 Tanks MEAN	Months in M60 Tanks S.D.	Months Since Last Table VIII MEAN	Months Since Last Table VIII S.D.	Never Fired Table VIII	Months TC and Gunner Have Served Together MEAN	Months TC and Gunner Have Served Together S.D.
EXPERIMENTAL GROUP	TC	(46-47)	E-6	9.7	9.4	38.0	37.0	54.9	37.0	7.3	6.7	6%	5.5	5.7
	Gunner	(46-48)	E-5	8.0	7.1	20.0	19.2	35.6	21.8	6.5	4.7	19%		
	Loader	(36-40)	E-3	6.7	6.3	15.5	14.1	18.9	13.5	5.8	2.2	28%		
	Driver	(30-37)	E-4	7.9	7.7	24.6	20.3	28.6	17.8	6.6	3.3	17%		
	Overall	158-172	E-4	8.2	7.8	24.9	26.0	35.5	28.1	6.6	4.8	17%		
COMPARISON GROUP	TC	(49-51)	E-6	10.1	9.8	47.7	48.9	65.4	55.8	6.7	5.7	0%	5.0	4.9
	Gunner	(48-50)	E-4	8.1	6.9	19.5	14.9	35.9	14.8	7.0	6.2	6%		
	Loader	(46-48)	E-3	8.1	5.5	10.8	9.3	16.4	10.3	6.3	4.3	36%		
	Driver	(46-47)	E-3	8.5	5.6	15.2	8.8	21.8	13.3	5.3	1.4	36%		
	Overall	189-196	E-4	8.7	7.2	23.8	30.6	35.5	36.0	6.4	5.0	19%		

[1] The data was compiled from the Tank Crew Training Questionnaire. The range of respondents across various items is shown in parentheses.

The baseline gunnery proficiency of the two groups is summarized in Table 2 and Table 3. Table 2 shows the number and percentage of tank crews in both groups who qualified on their last Table VIII firings at Grafenwoehr. Minimum qualification required that the crew must have met the target engagement and time requirements for seven out of ten tasks in the table. The Comparison Group qualified 98 percent of the crews versus only 33 percent for the Experimental Group.

Table 3 shows a breakdown of the type of engagements fired and the percentage of tank crews qualifying on each. Compared to the Experimental Group a considerably greater percentage of crews in the Comparison Group qualified on all types of engagements. Based on previous Table VIII scores the Comparison Group had a clear advantage in baseline gunnery proficiency.

The extent to which the subject variables discussed above had an effect on criterion gunnery performance in the present study is not known. Results will be presented later showing that there was no correlation between some of the experience measures and gunnery performance. However, the differences cannot be dismissed and are relevant to interpreting the results of the training effectiveness evaluation.

PROCEDURE

Experimental Group Crew Training

All training was administered and conducted by unit training personnel. The Experimental Group trained exclusively on the Prototype Tank Crew Training Program. The detailed training objectives, implementation procedures, and criterion score sheets are contained in Appendix A. The battalion master gunner had primary responsibility for the overall implementation of the training program. He was assisted by other master gunners in the battalion, each of whom had responsibility for one or more of the training stations. Training was conducted over a four week period prior to qualification firing at Baumholder. Prior to the start of the training program, all crew members completed their Tank Crew Gunnery Skills Test (TCGST).

HumRRO research personnel worked closely with all of the master gunners in the development and implementation of the training procedures. Each of the training station administrators had a copy of the Tank Crew Training Program Outline for USAREUR Units (Miller, 1977) which served as the guideline for the conduct of training. Using this guide and inputs from research personnel, training and evaluation score sheets were developed for each of the stations. Training equipment and material were then acquired and each of the stations was set up in the local training area. The Battalion S-3 developed a master training schedule which designated the sequence of training activity for the individual units. Units were usually assigned by company to train on a particular station.

Each station was designed to function autonomously. With the exception of Station 1, which was required as the first training station for

TABLE 2

BASELINE GUNNERY PERFORMANCE: PERCENTAGE OF TANK CREWS QUALIFYING OVERALL[1] ON PREVIOUS TABLE VIII AT GRAFENWOHR

Groups	Crews Completing All Engagements	Number of Crews Qualifying	Percent Qualifying
Experimental Group	45	15	33%
Comparison Group	52	51	98%

[1]Overall qualification is based on combined day and night engagements.

TABLE 3

BASELINE GUNNERY PERFORMANCE: PERCENTAGE OF PREVIOUS TABLE VIII ENGAGEMENTS, BY TYPE, ON WHICH CREWS MET QUALIFICATION STANDARDS

Engagements		Experimental Group		Comparison Group	
		N	Standards Met	N	Standards Met
Day	Main gun	104	58%	106	88%
	Machine gun	104	48%	106	75%
	Main gun and machine gun	52	38%	53	89%
	Overall Day	260	50%	265	83%
Night	Main gun	135	43%	157	82%
	Machine gun	45	53%	53	87%
	Overall Night	180	46%	210	83%

everyone, stations could be trained in any sequence. To the extent that scheduling and resources permitted, training was conducted concurrently for several of the stations. On any particular station the training was administered as follows. The master gunner or assistant instructor explained the purpose of the station and the training objectives and procedures for each of the tasks. Individuals or crews then performed the task and results were recorded on the training and evaluation score sheets. Where appropriate the station administrator critiqued the performance and provided remedial instruction.

Because of the limited time available to train the entire battalion and the intrusion of other duties, it was not possible for everyone to train and meet criterion on all of the stations. Table 4 shows the training results for the Experimental Group in terms of the percentage of participants completing a station and the percentage of those completing who met criterion on the station. Looking at the overall averages, 79 percent of the tank commanders completed the stations appropriate to them, and 80 percent of the gunners completed their training stations. Of those completing the stations 90 percent and 89 percent respectively met criterion. On the crew stations, which included the TC and gunner, 89 percent of the crews completed their stations and 95 percent of those met criterion.

Comparison Group Crew Training

The Comparison Group trained according to their established battalion tank crew training program. The main elements of this program required that all platoons train at least once a month on the Armor Crew Combined Training Course (ACCTC) and the scaled Mini-Tank Range (MTR). This training was supplemented by classroom gunnery instruction and the TCGST. Table 5 summarizes the training activity of the Comparison Group in the six weeks prior to the criterion test.

The ACCTC was conducted as a single tank move-out course and patterned after the conventional Gunnery Table VIII Tank Combat Course. Tanks moved through the course individually, accompanied by an Assistant Instructor (AI), and simulated firing engagements with 1/2 scale targets. Engagement simulation consisted of target acquisition, fire command, laying and aiming of main gun, and dry fire. The evacuation of injured crew members and CBR conditions were also practiced during the run. Following an exercise the AI debriefed the crew on their performance. Crews trained on both a day and night version of the ACCTC. Those crews not on the course participated in concurrent training such as aircraft and vehicle identification, REDEYE, or practiced one-on-one tank engagements.

The scaled tank range was used for subcaliber firing (cal. .22 and Brewster device) of Gunnery Tables I, II, and III (FM 17-12-2). In addition Table VP was fired using 1/60 scale targets. All crews trained on both day and night exercises on the MTR. (No machine gun engagements were included in either the ACCTC or the MTR.)

TABLE 4

EXPERIMENTAL GROUP TRAINING RESULTS

	TRAINING PARTICIPANTS					
	Tank Commanders		Gunners		All Crew Members	
TRAINING STATIONS	Completed Station	Met Criterion	Completed Station	Met Criterion	Completed Station	Met Criterion
Station 1	80%	91%	89%	96%		NA
Station 2	65%	94%	59%	94%		NA
Station 3[1]	82%	93%		NA	85%	100%
Station 4	91%	84%	93%	80%		NA
Station 5		NA		NA	91%	100%
Station 6[2]		NA		NA	92%	79%
Overall	79%	90%	80%	89%	89%	95%

[1]Task 1 of station 3 required all crew members, task 2 and 3 required the TC only.

[2]The percentages are based on only two companies. Company A did not train on station 6 for experimental manipulation purposes.

TABLE 5

COMPARISON GROUP TRAINING ACTIVITIES IN SIX WEEKS PRIOR TO GUNNERY QUALIFICATIONS AT BAUMHOLDER

Activity	Average Number of Days Spent on Activity by Each Platoon
ACCTC	2
Mini-Tank Range	2
TCGST	1
Gunnery Classes	3

Gunnery classes conducted by the Comparison Group consisted of standard subjects such as boresight and zero techniques, pre-fire checks, use of rangefinder, precision gunnery, and assembly and disassembly of machine guns.

Criterion Testing

The measures of primary interest for evaluating the prototype training program's effectiveness were based on Table VI Gunnery Performance. Table VI included both day and night phases; however, no data was collected on the night phase. This decision was based on two facts: (1) Current doctrine does not allow searchlight illumination for nighttime engagements. Consequently targets are illuminated either by mounting lights on the targets or providing indirect mortar illumination. Both battalions ran into considerable problems with both techniques. Lights were shot off of targets and overhead illumination was not placed accurately. (2) Sensing target hits in the dark could not be accomplished with any degree of accuracy or reliability.

The day Table VI consisted of both main gun and machine gun engagements, three main gun and three machine gun. HEAT-TPT ammunition was used for all main gun engagements. Appendix B contains the Table VI evaluation scorecard which details the target scenario and standards for each engagement.

Each tank company was allocated one day to complete Table VI firing. The conduct of the range was controlled by the company commander. The engagements were fired in the sequence shown on the scorecard except when time on the range became critical. In those instances most company commanders opted to shoot all of the main gun engagements in sequence first and, when those were finished, the machine gun engagements were fired. On several occasions, for both battalions, the ranges were closed for a few hours each day because of grass fires. This loss of time prevented some crews from completing all of their day engagements.

All crews fired individually from a concrete pad with up to ten tanks on line at a time. Prior to initiating live fire the company commander led all crews through a dry run of the engagements. This was necessary to familiarize the crews with the specific targets they were to engage. The range was not automated for pop-up targets but rather provided a combination of pull-up, moving and standing targets. In addition, there were a number of boresight panels on the range which were not to be engaged. Consequently, since there were more targets visible than those that should be engaged, the dry run was required. Having more than one tank on line and using the dry run obviously diminished or completely eliminated the opportunity to exercise two important gunnery functions, namely target acquisition and ranging.

A final point is relevant to the Table VI criterion test. Since there was no opportunity to repair targets during the course of the exercises, when a target became unserviceable, a similar target at a similar range was substituted.

Gunnery performance data was also collected for both battalions on Table VIII and IX. Table VIII was a multiple tank battle run in which a tank section (either heavy or light) engaged multiple targets with main guns and machine guns. The Experimental Group used a defensive scenario with retrograde movement while the Comparison Group used an attack scenario with forward movement. The scenarios were based on the General Defensive Plans (GDP) of the two battalions. Appendix B contains the scorecards, individual engagements, and standards for the two scenarios. The scorecard for the Comparison Group specifies NACCA subcaliber firing for the main gun engagements. Since the battalion had sufficient main gun rounds allocated, these engagements were actually fired with HEAT-TPT. The conduct of the Table VIII engagements was again under the control of the respective company commanders. As with Table VI, only day firing data were collected.

Table IX was the tank platoon qualification course. It consisted of NACCA engagements, main gun and machine gun engagements designed around a defensive, retrograde scenario. Appendix B contains the detailed scenario for both day and night phases. The administration and conduct of Table IX was controlled by the Brigade Table IX Control and Evaluation Team.

Scoring

All scoring on Tables VI and VIII was accomplished by HumRRO research personnel. The scorers were located in the control tower where they had a complete view of the range and all of the targets.

The following measures were obtained for each engagement on Table VI: time-to-fire (opening time), time to first hit, hit-miss (sensing) of each round, and total engagement time. Sensing of each round was accomplished using 7 x 50 binoculars. The person doing the sensing was a former Army officer (Armor Branch) with considerable experience in tank gunnery. Times were kept using three stop watches. All watches were started either on the fire command or when the first target became visible. Watches were then stopped when the first round was fired (opening time), when the first target hit was achieved, and when the last target was hit or the last allocated round for the engagement was expended. At the beginning of the engagement gunners were instructed to lay their guns on the pole marking the edge of the range thus making timing equivalent for all crews. All data were recorded on the Table VI score sheet (Appendix B).

Scoring on Table VIII consisted of sensing the total number of targets hit per engagement and measuring total engagement times. The Table VIII scorecard (Appendix B) for the respective battalions was used for data recording.

The day and night phases of Table IX were scored entirely by the brigade control and evaluation team. Only pop-up targets were used and these were presented for a total of 40 seconds during the day engagements and 60 seconds during the night engagements. Two measures were collected for all engagements; total number of targets presented, and total number of targets hit.

For NACCA type engagements, target hits were determined by counting the number of targets which fell as a result of firing. (NACCA targets were 1/2 scale tank targets which fell when hit by a cal. 50 round.) All other targets were full scale and target hits were physically scored. That is, at the end of the exercise the evaluation team examined each target for a hit and patched those targets hit.

Tank Crew Training Questionnaire

All crew members in both the Experimental and Comparison Battalions were asked to fill out a training opinion questionnaire prior to their criterion test firing. The questionnaires (Appendix C) consisted of 16 items. The first part was concerned with biographical and background information. The second part consisted of multiple choice questions designed to assess the crew members' opinions on such areas as the value of the training, the conduct of the training, and the importance of certain training elements.

Because of the large number of crew members involved (approximately 200 in each battalion) and problems of administration, it was not possible to get completed questionnaires from all training participants.

RESULTS

The gunnery performance results are presented separately for each of the criterion test gunnery tables. All results presented are based on battalion averages. As indicated previously, Company A in the Experimental Group did not train on Station 6. This manipulation was introduced to determine if the absence of this training would have a differential effect on criterion performance. Preliminary comparisons of Company A gunnery performance versus the other two companies indicated no systematic differences in their performance. Therefore, the data from all three companies was combined for subsequent data analysis.

TABLE VI PERFORMANCE

Looking at gunnery performance from the viewpoint of training readiness, the first question of interest is how many crews met the performance standards for Table VI gunnery. Table 6 shows the percentage of tank crews in the Experimental and Comparison Groups who met the overall standards on the Table VI day engagements. The performance criterion of meeting the

TABLE 6

PERCENTAGE OF TANK CREWS MEETING
OVERALL STANDARDS ON TABLE VI[1]

Groups	Crews Having an Opportunity to Fire	Crews Completing All Engagements	Crews Meeting Standards[2]	Percent Meeting Standards
Experimental Group	54	41	5	12%
Comparison Group	43	30	4	13%

[1] All data on Table VI is for day firing only.

[2] Meeting standards requires that all targets are hit within a prescribed time limit on 4 of 6 engagements.

TABLE 7

PERCENTAGE OF TABLE VI ENGAGEMENTS,
BY TYPE, ON WHICH CREWS MET
PERFORMANCE STANDARDS[1]

Engagements	Experimental Group		Comparison Group	
	N	Standards Met	N	Standards Met
Main Gun	158	18%	128	24%
Machine Gun[2]	147	44%	100	30%
Overall Engagements	305	30%	228	27%

[1] Meeting standards on an engagement requires that all targets are hit within a specified time limit.

[2] Statistically significant difference between groups, ($p < .05$).

standards on four of six engagements is based on a proportional interpolation of the total day/night performance standard. Standards for individual engagements are contained in the Table VI scorecard (Appendix B).

The results show that the Experimental and Comparison Groups are almost identical in terms of the percentage of crews meeting standards. Also shown in the table is the fact that all of the crews in the Experimental Group were able to fire (54), while only 43 of the crews in the Comparison Group were able to fire. Crews not being able to fire and incomplete overall engagements were due mostly to the lack of time on the range. This resulted because the range was shut down periodically for grass fires. Mechanical malfunctions on tanks also contributed to incomplete data.

Table 7 summarizes the performance results in terms of the types of engagements fired. The table shows the number of main gun engagements and machine gun engagements fired, and the percentage of those on which the crews met the performance standards. Crews in the Comparison Group met standards on a larger percentage of main gun engagements, while crews in the Experimental Group met standards on a greater percentage of machine gun engagements. Overall, each group met standards on approximately one third of the engagements. The z-test for the Significance of Difference Between Two Proportions was computed on the percentages in Table 7 to compare the two groups. There was a statistically significant difference between the groups on the machine gun engagements ($z=3.26$, $p < .05$), but not on the main gun or overall engagements.

The very basis of gunnery proficiency is hitting the target being engaged. Table 8 summarizes target hit performance in terms of Mean Percentage Main Gun Hits (number of targets hit divided by the rounds fired); Mean Percentage Coax Coverage; and Mean Percentage of Cal.50 Targets Hit (targets hit divided by targets presented). The Comparison Group showed the best main gun hit performance while the Experimental Group achieved the greatest percentage of Cal.50 machine gun target hits. The differences between groups were statistically significant on both types of engagements, z (main gun) = 3.39, $p < .05$; z (cal. 50) = 3.54, p .05. There was no difference between the groups on coax machine gun coverage.

Table 9 shows the mean firing times of the two groups for main gun engagements. Table 10 summarizes the machine gun firing times. The Comparison Group had faster main gun opening times, time to first hit, and completed the engagements in a shorter time. On the machine gun engagements, the Comparison Group again had faster opening times; however, the Experimental Group showed shorter total engagement times. The only statistically significant difference in firing times between the two groups was for main gun total engagement time, $t\ (94) = 2.25$, $p < .05$.

TABLE 8

TARGET HIT PERFORMANCE FOR MAIN GUN
AND MACHINE GUN ENGAGEMENTS, TABLE VI

Gunnery Performance	Experimental Group	Comparison Group
Mean Percentage Main Gun Hits*	40%	48%
Mean Percentage Coax Coverage	72%	72%
Mean Percentage of cal. 50 Targets Hit*	84%	72%

*Statistically significant difference between groups ($p < .05$).

TABLE 9

MEAN FIRING TIMES IN SECONDS FOR MAIN GUN ENGAGEMENTS, TABLE VI

Firing Times	Experimental Group MEAN	Experimental Group SD	Comparison Group MEAN	Comparison Group SD
Time to Open	8.4	4.6	7.2	3.5
Time to First Hit	19.4	13.7	16.1	13.5
Total Engagement Time[1]	44.1	16.0	38.1	13.0

[1]Statistically significant difference between groups ($p<.05$)

TABLE 10

MEAN FIRING TIMES IN SECONDS FOR MACHINE GUN ENGAGEMENTS, TABLE VI

Firing Times	Experimental Group MEAN	Experimental Group SD	Comparison Group MEAN	Comparison Group SD
Time to Open	5.7	7.1	5.1	4.9
Total Engagement Time	32.8	12.7	36.3	17.2

TABLE 11

FIRST ROUND MEAN HIT PROBABILITY ($\bar{P}_h$) AND PERCENTAGE OF ENGAGEMENTS ON WHICH NO HITS WERE ACHIEVED, MAIN GUN TABLE VI

Groups	Total Engagements Fired	First Round Hits	$\bar{P}_h$*	Engagements With No Hits	Percentage No Hits*
Experimental Group	158	53	.335	49	31%
Comparison Group	128	60	.468	30	23%

*Significant difference between groups ($p<.05$).

TABLE 12

EXPERIMENTAL GROUP PERFORMANCE ON TABLE VIII
(MULTIPLE TANK BATTLE RUN-DAY-DEFENSE)

Engagements	N	Overall Standards Met[1]	Met Target Hit Standard Only[2]
Main Gun	36	8%	36%
Machine Gun	24	25%	71%
Overall Engagements	60	15%	50%

[1]Overall standard required 70% target hits within a specified time limit.

[2]Target hit standard was 70%.

TABLE 13

COMPARISON GROUP PERFORMANCE ON TABLE VIII C
(MULTIPLE TANK BATTLE RUN-DAY-ATTACK)

Engagements	N	Overall Standards Met[1]	Met Target Hit Standard Only[2]
Main Gun	27	19%	63%
Machine Gun	27	59%	63%
Main Gun and Machine Gun	14	7%	29%
Overall Engagements	68	32%	56%

[1]Overall standard required 70% target hits within a specified time limit.

[2]Target hit standard was 70%.

TABLE 14

PERCENTAGE OF TARGETS HIT BY PLATOONS,
TABLE IX (DAY AND NIGHT)

Platoons	Experimental Group		Comparison Group	
	Percentage Hits		Percentage Hits	
	Day	Night	Day	Night
1	63	61	77	58
2	68	60	79	64
3	63	53	79	67
4	69	50	76	69
5	73	64	75	73
6	66	59	82	65
7	54	66	76	63
8	71	63	79	91
9	69	68	83	76
Overall	66%	60%	78%	68%
Number of Platoons Qualifying[1]	2	0	9	3

[1]Qualification on Table IX requires 70% target hits.

Two final measures of effectiveness are relevant to gunnery proficiency; (1) main gun first round hit probability, and (2) percentage of main gun engagements in which no target hits were achieved. Table 11 shows that the Comparison Group performed better on both of these measures. The differences between the two groups were statistically significant on both measures, z ($\bar{P}_h$)=3.33, $p < .05$; z (no hits) = 2.17, $p < .05$.

TABLE VIII PERFORMANCE

Gunnery Table VIII was the tank section battle run. The Experimental and Comparison Groups each used a different tactical scenario and fired different engagements on this table. It was therefore not possible to compare the groups directly on any common measures. The groups were evaluated, however, against the standards for their respective engagements.

The data were first analyzed to determine how many tank sections met the standards on the overall engagements for the respective tables. The results showed that no tank section in either the Experimental or Comparison Group qualified on all engagements in a table. Results were then analyzed in terms of individual engagements.

Table 12 summarizes the performance of the Experimental Group on the Table VIII defensive scenario. Shown in the table are the number of main gun engagements and machine gun engagements that were fired and the percentage of those on which tank sections met the overall standard and the target hit standard only. As indicated in the table, machine gun performance was better than main gun performance. In addition, the results indicate that it was easier to meet the target hit standards alone than the overall time and hit standard.

Equivalent summary performance results for the Comparison Group are presented in Table 13. In addition to the main gun engagements and machine gun engagements, the Comparison Group also fired simultaneous main gun/machine gun engagements. The performance trends of the Comparison Group were similar to those of the Experimental Group. The main difference was that the Comparison Group met overall standards on a greater percentage of their engagements.

TABLE IX PERFORMANCE

The performance measures for Table IX consisted of the percentage of targets hit on day and night engagements. The 8th Infantry Division Standard for platoon qualification on Table IX requires that the platoon hit at least 70% of the total targets presented in the exercise.

Table 14 presents the percentage target hit results for each platoon on both day and night engagements. As indicated in the table, the Comparison Group qualified all of their platoons on the day engagements and three

TABLE 15

MEAN PERCENTAGE OF TARGETS HIT BY TYPE
OF ENGAGEMENT, TABLE IX (DAY)

Engagements	Experimental Group		Comparison Group	
	Targets Presented	Targets Hit	Targets Presented	Targets Hit
NACCA*	95%	84%	83%	98%
Main Gun - Stationary Targets*	82%	38%	70%	55%
Main Gun - Moving Targets	97%	63%	100%	61%
Machine Gun	90%	82%	76%	87%
Overall*	90%	66%	78%	78%

*Statistically significant differences between groups ($p < .05$).

TABLE 16

MEAN PERCENTAGE OF TARGETS HIT BY TYPE
OF ENGAGEMENT, TABLE IX (NIGHT)

Engagements	Experimental Group		Comparison Group	
	Targets Presented	Targets Hit	Targets Presented	Targets Hit
NACCA	94%	70%	74%	69%
Main Gun - Stationary Targets*	82%	38%	60%	56%
Main Gun - Moving Targets	81%	38%	63%	50%
Machine Gun	91%	87%	76%	92%
Overall*	88%	60%	69%	68%

*Statistically significant differences between groups ($p \leq .05$).

TABLE 17

MEAN PERCENTAGE OF TARGET HITS BY TANK SECTION ENGAGEMENTS, TABLE IX (DAY)[1]

	Experimental Group Percentage Targets Hit	Comparison Group Percentage Targets Hit
Light Section	46%	47%
Heavy Section[2]	60%	83%

[1]NACCA engagements are not included since these required platoon rather than section fire.

[2]Statistically significant difference between groups ($p<.05$).

TABLE 18

CORRELATIONS BETWEEN THE TOTAL NUMBER OF TARGETS PRESENTED IN AN ENGAGEMENT AND THE PERCENTAGE OF TARGETS HIT, TABLE IX (DAY)[1]

	Experimental Group Percentage Targets Hit	Comparison Group Percentage Targets Hit
Light Tank Section Engagements	+.17	-.53*
Heavy Tank Section Engagements	+.41*	-.41*

[1]NACCA engagements not included.

*Statistically significant correlation coefficient ($p<.05$).

platoons on the night engagements. The Experimental Group qualified two platoons during the day and none at night.

The percentage of targets hit are summarized by type of engagement on Table 15 (day phase) and Table 16 (night phase). Also shown in the tables are the mean percentage targets presented during the engagements. These percentages were based on the total number of targets scheduled for presentation. The results show that the Comparison Group consistently hit a greater percentage of targets in most engagement categories for both day and night operations. However, their performance was significantly different from the Experimental Group only on main gun - stationary targets and overall targets (both day and night phases) and NACCA engagements (day phase): z (NACCA-day) = 6.38; z (main gun-day) = 3.94; z (overall-day) = 5.29; z (main gun-night) = 3.94; z (overall-night) = 3.19, $p < .05$. Also indicated in the table is the fact that the Experimental Group consistently had more targets presented during the engagements than the Comparison Group.

With the exception of NACCA engagements, in which the entire platoon fired at all targets, all other engagements were fired as individual tank section engagements. Table 17 summarizes the mean percentage target hits in terms of light section engagements and heavy section engagements during the day phase (equivalent data for the night phase were not available). The results indicate that the light tank sections in the two groups performed almost identically, but there was a significant difference between the heavy tank sections with the Comparison Group achieving a greater percentage of hits ($z = 5.71$, $p < .05$). Within groups the heavy sections achieved more target hits than the light sections, which is to be expected since a heavy section is composed of three tanks while there are only two tanks in a light section.

Data presented in Tables 15 and 16 showed that the Experimental Group consistently received more targets to shoot at on their engagements than did the Comparison Group. Malfunctions in the target lift mechanisms were the primary cause of targets not being presented and for some reason these occured more often during the Comparison Group engagements. The question was asked whether the Comparison Group ahcieved a greater percentage of target hits because they had fewer targets to shoot at. It seems likely, for example, that a tank section firing at five targets should hit a greater percentage of those five than if they were shooting at eight targets.

Correlations were computed on the data to test this possibility. The number of targets presented in an engagement was correlated with the percentage of targets hit. Correlations were computed separately for the light tank section engagements and the heavy tank section engagements. Table 18 shows the results of these correlations. The Experimental Group results showed positive correlation coefficients for both light and heavy section engagements with the correlation coefficient for the heavy section engagements being statistically significant ($p < .05$). The correlations for the Comparison Group were both negative and both statistically significant

TABLE 19

EXPERIMENTAL GROUP: CORRELATIONS BETWEEN NUMBER OF TRAINING TASKS SATISFACTORILY COMPLETED AND MAIN GUN PERFORMANCE, TABLE VI

Training Tasks Completed	Performance	
	Mean Hit Percentage	Mean Opening Times
	r	r
Gunner Alone	-.23	.02
Tank Commander Alone	-.21	.13
TC and Gunner Tasks Combined	-.27	.10

TABLE 20

CORRELATIONS BETWEEN PRIOR EXPERIENCE OF CREW MEMBERS AND MAIN GUN PERFORMANCE, TABLE VI

Prior Experience	Experimental Group		Comparison Group	
	Mean Hit Percentage	Mean Opening Times	Mean Hit Percentage	Mean Opening Times
	r	r	r	r
Months Gunner and TC Have Served Together	-.11	-.09	-.05	-.20
Months Gunner Has Served in His Position	.22	-.04	-.09	.03

($p < .05$). The results suggest that for the Experimental Group tank section engagements, the more targets presented the greater the percentage of targets hit. The Comparison Group correlations show just the opposite effect, namely the more targets presented, the lower the percentage of hits.

TRAINING RELATED TO CRITERION PERFORMANCE

One of the objectives of the current study was to determine, to the extent possible, the effects that various prototype training program elements might have on criterion performance on Table VI. The extent to which this objective was actually achieved was very limited for two reasons: (1) there was insufficient training time available to generate the necessary data for a detailed analysis of training effects, and (2) the Table VI criterion test did not provide some critical gunnery functions which were emphasized in the training program, namely, target acquisition and ranging.

Correlation coefficients were computed to determine if there was a general relationship between the number of training tasks satisfactorily completed by various crew members and main gun performance on Table VI. Table 19 shows the variables correlated and the resulting correlation coefficients. None of the correlation coefficients shown were significantly different from zero ($p < .05$). The results suggest that there was no relationship between either mean hit percentage or mean opening times and the number of training tasks satisfactorily completed by either the gunner, the tank commander, or the TC and gunner tasks combined.

Other variables which might be related to gunnery performance are the general background experience of the crew. In terms of Table VI performance, the time the tank commander and gunner have served together and the time the gunner has served in his position are both relevant variables. Table 20 shows the correlation coefficients between each of these variables and main gun performance. Again none of the correlations were significantly different from zero for either the Experimental Group or the Comparison Group indicating no relationship between the variables.

TRAINING OPINION QUESTIONNAIRE

The responses to the multiple choice questions on the Crew Training Questionnaire are presented in Table 21. The table shows the percentage of responses, by duty position, to each of the multiple choice items. The overall responses to each item, averaged across duty positions, are also presented.

Tank crews in the Experimental and Comparison Groups showed a high degree of similarity in their responses to questions 2, 3, 6, and 7 and the results are self explanatory. The remaining questions do indicate some differences in opinions between the two groups which may be a reflection of their differential training experience. Comparing the two groups on question 1 shows that a relatively smaller percentage of crew members

TABLE 21

CREW TRAINING QUESTIONNAIRE RESULTS

ITEM	EXPERIMENTAL GROUP					COMPARISON GROUP				
	TC	GNR	LDR	DRV	ALL	TC	GNR	LDR	DRV	ALL
	%	%	%	%	%	%	%	%	%	%
1. Do you think that the training you received over the last month or so will help you for your tank crew gunnery qualifications at Baumholder?										
Will help a lot.	19	19	28	24	22	41	27	32	38	35
Will help a little.	57	50	38	41	46	49	50	30	36	41
Will not make any difference.	19	27	33	47	29	6	23	36	24	22
Will hinder my performance.	4	4	3	0	3	4	0	2	2	2
2. Do you think that the tasks you trained on involved the same kinds of skills that you will expect to use for your crew gunnery qualification tables?										
Yes, the same type.	40	10	23	24	24	43	16	32	22	29
Some differences.	40	63	58	54	53	47	55	53	61	54
Many differences.	13	13	8	14	12	6	18	9	13	11
No, skills are not the same.	6	15	13	8	10	4	10	6	4	6
3. Overall, how well did you like the training you received in the last month?										
Liked very much.	4	10	0	11	7	6	2	9	4	5
Liked somewhat.	51	31	46	25	39	51	29	38	39	39
Didn't like or dislike.	9	19	19	39	20	22	31	31	24	27
Disliked somewhat.	9	15	14	14	13	10	17	7	15	12
Disliked a lot	28	25	22	11	22	10	21	16	17	16
4. Overall, do you think that you receive enough tank gunnery training at your local training area during the year?										
Receive more than enough.	17	20	30	31	24	34	63	44	48	47
Receive enough.	35	39	38	53	41	42	29	44	48	41
Need more training.	47	44	32	17	36	24	8	11	4	12

TABLE 21 (Continued)

CREW TRAINING QUESTIONNAIRE RESULTS

ITEM	EXPERIMENTAL GROUP					COMPARISON GROUP				
	TC	GNR	LDR	DRV	ALL	TC	GNR	LDR	DRV	ALL
	%	%	%	%	%	%	%	%	%	%
5. Did you have enough time to practice all of the tasks that you trained on?										
Enough time for all tasks.	21	32	28	47	30	40	52	39	51	46
Enough time for some tasks.	38	47	46	47	43	38	40	41	42	40
Not enough time on most tasks.	40	21	26	19	27	22	8	20	7	14
6. Did you receive a briefing or explanation for each task that you trained on so that you knew what you were supposed to do and why?										
On all tasks.	49	53	47	46	49	57	47	43	56	51
On some tasks.	23	34	42	47	34	35	43	39	36	38
On very few tasks.	26	13	5	11	14	8	10	13	9	10
On none of the tasks.	2	0	5	3	2	0	0	5	0	1
7. Did you have any problems or failures with the equipment on your tank during training?										
A lot of problems.	16	13	14	6	13	18	8	6	11	11
A few problems.	53	53	52	74	58	61	65	72	59	64
No problems at all.	30	33	33	20	30	22	27	21	30	25
8. Did you have any problems or failures with the training equipment (Brewster device, laser, targets) during training?										
A lot of problems.	26	27	11	14	20	46	47	30	24	37
A few problems.	52	50	61	64	56	42	41	46	49	44
No problems at all.	22	23	28	22	23	12	12	24	27	18

TABLE 22

Training Tasks Ranked as Most Important by Crew Position

EXPERIMENTAL GROUP

All crew members combined			TC		GUNNER		LOADER		DRIVER	
Rank	Task	Index[1]	Rank	Index	Rank	Index	Rank	Index	Rank	Index
1.	Target acquisition and identification	.33	1	(.55)	2	(.33)	8	(.12)	2	(.29)
2.	Laying the main gun and aiming	.30	2	(.32)	3	(.27)	2	(.23)	1	(.38)*
3.	Estimation of lead for moving targets	.27	3	(.29)	1	(.37)	5	(.18)*	4	(.20)
4.	Adjusting fire on targets	.26	4	(.25)	4	(.25)	1	(.31)	3	(.24)
5.	Tactical driving	.16	10	(.04)*	9	(.06)	3	(.21)*	1	(.38)*
6.	Ranging on targets	.16	5	(.22)	8	(.08)*	3	(.21)*	6	(.11)
7.	Range card data	.15	8	(.08)	5	(.21)	6	(.14)	5	(.18)
8.	Tracking moving targets	.12	7	(.09)	6	(.18)	7	(.13)	7	(.09)
9.	Moving tank range-laser firing	.10	6	(.09)	7	(.15)	9	(.08)	8	(.06)
10.	Immediate action on main gun and machine guns	.07	9	(.04)	10	(.02)	4	(.19)	10	(.03)
11.	Mini tank range sub-caliber firing	.05	10	(.04)*	8	(.08)*	10	(.03)	9	(.05)
12.	Loading main gun	.04	11	(.01)	11	(.01)	5	(.18)*	11	(.00)

COMPARISON GROUP

All crew members combined			TC		GUNNER		LOADER		DRIVER	
Rank	Task	Index[1]	Rank	Index	Rank	Index	Rank	Index	Rank	Index
1.	Target acquisition and identification	.31	2	(.38)	2	(.29)	1	(.29)	2	(.28)
2.	Laying the main gun and aiming	.31	1	(.40)	3	(.25)	2	(.24)	1	(.34)*
3.	Adjusting fire on targets	.30	3	(.33)	1	(.40)	4	(.21)	3	(.24)*
4.	Tactical driving	.20	7	(.10)	5	(.22)	9	(.14)	1	(.34)*
5.	Tracking moving targets	.20	4	(.20)	7	(.16)	5	(.19)	3	(.24)*
6.	Estimation of lead for moving targets	.18	5	(.16)	4	(.24)	3	(.22)	7	(.09)
7.	Ranging on targets	.14	6	(.15)	8	(.15)	10	(.12)	4	(.16)
8.	Range card data	.13	8	(.09)	6	(.17)	8	(.16)	5	(.11)
9.	Immediate action on main gun and machine guns	.08	12	(.02)	9	(.05)	6	(.17)	6	(.09)
10.	Mini tank range sub-caliber firing	.06	9	(.08)	10	(.04)	11	(.09)	9	(.04)*
11.	Loading main gun	.06	11	(.03)	12	(.01)	7	(.17)	8	(.05)
12.	Moving tank range-laser firing	.04	10	(.06)	11	(.03)	12	(.02)	9	(.04)*

[1] The index number is arbitrarily derived. All number 1 rankings received 3 points, 2 rankings received 2 points, and 3 rankings received 1 point. The number of points received by each task were summed and divided by the total responses on the task.

* Indicates actual tie. All numbers are rounded to second decimal place. Items having the same index score but no asterisk are ranked on the basis of the third decimal place number.

TABLE 23

Training Tasks Ranked as Least[1] Important by Crew Position

EXPERIMENTAL GROUP

All crew members combined			TC		GUNNER		LOADER		DRIVER	
Rank	Task	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index
1.	Mini tank range subcaliber firing	.41*	3	(.41)	2	(.42)	1	(.41)*	1	(.41)
1.	Loading main gun	.41*	2	(.43)	1	(.46)	2	(.36)	2	(.39)
3.	Tactical driving	.30	1	(.47)	3	(.33)	4	(.13)	5	(.19)
4.	Moving tank range-laser firing	.27	4	(.22)	4	(.22)	1	(.41)*	3	(.24)
4.	Range card data	.15	5	(.12)	5	(.10)*	3	(.17)	4	(.22)
5.	Immediate action on main gun and machine gun	.09	6	(.10)	5	(.10)*	8	(.08)	7	(.09)
6.	Target acquisition and identification	.09	8	(.06)	6	(.09)*	6	(.11)	7	(.09)
7.	Laying the main gun and aiming	.08	7	(.07)	6	(.09)*	5	(.12)	10	(.03)
8.	Estimation of lead for moving targets	.07	9	(.05)	7	(.07)	7	(.09)	8	(.08)
9.	Tracking moving targets	.05	11	(.02)*	10	(.02)	10	(.03)	6	(.16)
10.	Ranging on targets	.04	11	(.02)*	8	(.07)	9	(.06)	10	(.03)
11.	Adjusting fire on targets	.04	10	(.03)	9	(.05)	11	(.02)	9	(.07)

COMPARISON GROUP

All crew members combined			TC		GUNNER		LOADER		DRIVER	
Rank	Task	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index
1.	Mini tank range subcaliber firing	.60	1	(.50)	1	(.71)	1	(.59)	1	(.63)
2.	Moving tank range-laser firing	.32	3	(.32)	2	(.40)	4	(.25)	3	(.27)
3.	Loading main gun	.31	2	(33)	4	(.18)*	2	(.30)	2	(.40)
4.	Tactical driving	.22	4	(.23)	4	(.18)*	3	(.29)	4	(.19)
5.	Range card data	.15	5	(.20)	3	(.19)	5	(.12)	5	(.11)*
6.	Estimation of lead for moving targets	.09	6	(.14)	7	(.06)	6	(.09)*	8	(.04)*
7.	Target acquisition and identification	.07	10	(.04)*	5	(.10)	6	(.09)*	6	(.06)*
8.	Tracking moving targets	.06	9	(.05)*	10	(.02)	7	(.07)	5	(.11)*
9.	Adjusting fire on targets	.05	7	(.06)	11	(.01)	6	(.09)*	6	(.06)*
10.	Laying the main gun and aiming	.05	9	(.05)*	6	(.10)	9	(.01)	8	(.04)*
11.	Immediate action on main gun and machine guns	.05	10	(.04)*	9	(.02)	6	(.09)*	7	(.05)
12.	Ranging on targets	.04	8	(.05)	8	(.04)	8	(.03)	9	(.03)

[1] Tasks are ranked from least to most important. The higher the index number the less important the item was judged.

* Indicates actual tie. All numbers are rounded to second decimal place. Items having the same index score but no asterisk are ranked on the basis of the third decimal place number.

in the Experimental Group thought that their training would help them a lot on their crew gunnery qualifications. This difference between groups may have been due to the fact that the Experimental Group had very limited time to train on the prototype training program whereas the Comparison Group had been training continuously on their program. This interpretation is supported by the responses to question 5 which asked if there was sufficient time to practice the training tasks. The overall responses to the question indicate that a greater percentage of crew members in the Experimental Group, as compared to the Comparison Group, felt that they did not have sufficient time to train on their tasks.

Question 4 asked if crew members received enough tank gunnery training at their LTAs during the year. The responses indicate that the Comparison Group felt they received enough or more than enough training while the trend for the Experimental Group was towards needing more training. The difference between groups on this question probably reflects the fact that the Comparison Group has more adequate training facilities than the Experimental Group and uses these facilities on a regular and frequent schedule.

Question 8 indicates that the Comparison Group had more problems with training devices than the Experimental Group. This may have been due to the relatively greater utilization, by the Comparison Group, of their scaled tank range which requires considerable use of training equipment and devices.

In addition to the multiple choice items, the questionnaire also contained two items which asked the crews to rank training tasks in terms of most importance and least importance. Twelve tasks were listed and respondents were asked to initially rank the three most important tasks by assigning the numbers 1, 2 and 3. The next item asked respondents to rank the three least important tasks in the same manner using the number 1 for the least important.

The results of the ranking for most important tasks are shown in Table 22. The first column shows the ranking of tasks from most to least importance based on the combined responses of all crew members. The remaining columns show the ranking of tasks by individual crew positions. The responses of the Experimental Group and Comparison Group were very similar. "Target acquisition and identification," and "Laying the main gun and aiming" were ranked first and second respectively by both groups. The Experimental Group ranked "Estimation of lead for moving targets" as third while the Comparison Group ranked the same task in the sixth position. "Adjusting fire on targets" was also ranked high by both groups. The relative high ranking of "Estimation of lead" by the Experimental Group may reflect the fact that many of the crew members had difficulty with this task during training.

Table 23 shows the results of the ranking in terms of least important tasks. Again there is a high degree of similarity between the groups in their ranking. "Mini tank range subcaliber firing" was rated as the least

important task by both groups and this was tied with "Loading main gun" in the Experimental Group. Both groups also agreed that "Moving tank range-laser firing" and "Tactical driving" ranked very low in importance. It is interesting to look at some of the rankings by crew position. As might be expected tasks which are directly performed by a particular crewman are, for the most part, ranked as more important by him than by other crew members.

A final questionnaire item called for an open ended response and asked what skills or tasks should receive more training. A wide variety of responses were received on this item, but the most frequent response for both groups called for more live fire training.

DISCUSSION

In the present study, as is the case with most if not all field studies, it was not possible to control all sources of variance which might have an effect on the variables being measured. Such things as the weather, grass fires, personnel turbulence, and equipment malfunctions, are impossible to predict and therefore basically uncontrollable. What can be presumed however, unless evidence to the contrary exists, is that these uncontrolled variables occur randomly and thus should not have a differential effect on the results being compared.

This study compared the gunnery performance of two battalions relative to each other and also relative to the gunnery standards of Tables VI, VIII, and IX. The purpose of the comparisons was to assess the relative effectiveness of the prototype tank crew gunnery training program.

The results of the Table VI gunnery showed that in terms of meeting the overall qualification standards, the Experimental and Comparison Groups performed the same. Both battalions qualified approximately 12 percent of their tank crews on Table VI. The performance results on individual engagements showed that the crews in the Comparison Group qualified on a greater percentage of main gun and total engagements, while the crews in the Experimental Group qualified on a greater percentage of machine gun engagements. However the differences between the groups were statistically significant only on the machine gun engagements. Analyzing the results in terms of pure gunnery performance measures showed that there were statistically significant differences between the groups on the mean percentage of main gun hits; the mean percentage of cal.50 targets hit; the main gun first round mean hit probability; and the percentage of engagements on which no hits were achieved. The Comparison Group performed better than the Experimental Group on all the measures except the percentage of cal. 50 targets hit. The analysis of the firing times indicated that there were no statistically significant differences between the groups except for the main gun total engagement time. On this measure the Comparison Group's total average engagement time was significantly less than the Experimental Group.

Overall, the results of gunnery Table VI performance indicate that the Comparison Group performed better on main gun engagements while the Experimental Group performed better on machine gun engagements. However, both groups performed the same, and not very well, in terms of meeting the overall gunnery qualification standards for the table. The latter fact is especially surprising since the Comparison Group qualified 98 percent of their crews on the previous Table VIII at Grafenwohr and only 13 percent here.

A number of reasons to explain this apparent lower level of performance could be proposed: (1) Table VI may be more difficult than Table VIII in terms of standards or required performance; (2) The crews may have been at a lower state of training readiness on Table VI; (3) Since Table VI is no longer required as a crew qualification test, the motivation level may have been lower for the crews; or finally (4), the measurement standards and procedures may not be reliable, and thus, large fluctuations in measured performance can occur from one evaluation period to the next.

It is not possible, given the present data, to specify with certainty which, if any, one of these factors or combination of factors contributed to the overall low performance level. In comparing the Grafenwoehr Table VIII and the Baumholder Table VI there is no indication that one is more difficult than the other either in terms of tasks that have to be performed or standards that have to be met. Considering training readiness state, it can be said that both groups trained prior to the criterion test and, in the case of the Comparison Group, this training was a continuation of the training which occurred prior to the previous Table VIII qualifications. In terms of motivation level, both groups knew that outside observers were recording their performance and all indicators pointed to the fact that both groups wanted to perform well. As far as reliability of measurement is concerned, only the procedures used on the present Table VI are known. Those procedures required that the same, experienced person use binoculars to sense all rounds and, to the extent that visual observation is possible, report which rounds hit the target and which rounds missed. In most cases this was not a difficult judgement to make. In the few cases where the target effect was uncertain, other observers in the tower were polled and the consensus of judgment was used to score the round. If there was no consensus the round was not counted in the data.

The Table VI results are the primary basis for evaluating the division of the prototype tank crew training program. The results suggest that the program is probably as effective as the conventional program of the Comparison Group, especially considering the fact that the baseline performance of the Comparison Group, based on previous Table VIII data, indicated a higher overall proficiency level. The fact that the Experimental Group performed better on machine gun engagements may reflect the greater training emphasis these engagements had in the prototype training program.

It is not possible to compare the Experimental and Control Groups directly on the Tank Section Battle Runs (Table VIII). Both groups followed different scenarios and fired different engagements. The analysis of two groups performance against their respective standards, however, showed that the Comparison Group met overall standards on a greater percentage of their engagements.

The Platoon Battle Run Performance, (Table IX), showed that all of the platoons in the Comparison Group qualified on the table while only two platoons in the Experimental Group qualified. Subsequent data analysis showed that the main differences between the groups were that the Comparison Group performed better on main gun engagements against stationary targets and also performed better on engagements involving the heavy tank section.

A curious finding related to Table IX was that the Experimental Group consistently had a greater percentage of targets to shoot at on their engagements. When the number of targets presented was correlated, for both groups, with the percentage of targets hit, the resulting correlations were significant and in the opposite direction for the two groups. The results indicated that for the Experimental Group, the more targets presented, the greater the percentage of targets hit, while for the Comparison Group, the more targets presented the lower the percentage of hits. The reason for these results is not clear.

The fact that the Comparison Group performed better than the Experimental Group on Table IX might be related to two factors; the training of the groups and/or the proficiency level on previous Table IX gunnery. The prototype tank crew training program that the Experimental Group used was not designed for platoon level training and therefore it was not expected that the training would necessarily enhance Table IX performance. The Comparison Group training results, on the other hand, showed that they did practice a Table VP on their scaled tank range which is a platoon level training exercise. How much this may have contributed to the present Table IX results is not known although it is possible to assume that this training had some beneficial effects.

To look at the prior Table IX proficiency level of the two groups, the scores of the last Table IX firings at Grafenwohr were compared. The results showed that the Experimental Group qualified all of their platoons at Grafenwohr while the Comparison Group, because of the weather, was only able to give five of their platoons an opportunity to fire and all of them qualified. Again, as with the Grafenwohr Table VIII results, previous performance was not a reliable predictor of present performance.

One of the objectives of the study was to determine if there was a relationship between training program elements and criterion test performance. The correlations computed between the number of training tasks completed and gunnery performance of the gunner and tank commander showed

there was no relationship between the variables. In addition, correlations computed for both the Experimental and Comparison Groups between prior experience of crew members and main gun performance showed no significant relationships. These results are not unusual. Bauer (1978)[1] also reported no significant correlation between months of experience as a gunner and Table VIII performance, and no significant correlation was found between training on the mini-tank range and Table VIII performance. Smutz (1976)[2] found no correlation between the time the gunner and tank commander had served together and tank gunnery criterion performance.

The results of the Training Opinion Questionnaire indicated that the Experimental and Comparison Groups were very similar in their responses to most of the questionnaire items. The main differences in opinions between the groups seemed to be related to the fact that the Experimental Group felt that they did not have sufficient time to train. An interesting finding from the questionnaire was that both groups were very similar in how they rated the relative importance of various training tasks. They both ranked "target acquisition and identification" as the most important training task and "mini-tank range subcaliber firing" as the least important training task.

The results of the prototype training program implementation indicated that there were no major problems related to the design, procedures, or standards of the program. Modifications were made to some standards and these are documented in Appendix A. Major problems existed in the administration and conduct of the mini-tank range; however, these problems were not related to the training program per se but are intrinsic to subcaliber range operations. The experience of implementing the program did emphasize the need for good and adequate planning and preparation prior to training and also the need to provide sufficient time to meet all the training objectives.

In addition to the findings relating to training program effectiveness, the results of this study also provide some implications for future research needs. The concept of tank crew gunnery training readiness is based on the assumption that gunnery performance can be measured and evaluated, and that these results can be used to determine the present readiness state of a unit and also specify future training needs. To meet this assumption more information is required to develop both valid tank gunnery performance measures

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[1]Bauer, Robert W., "Training Transfer From Mini-Tank Range to Tank Main Gun Firing." Technical paper 285, Army Research Institute, Alexandria, Va., Sept. 1978.

[2]Smutz, Edwin R., "An Assessment of Factors Influencing Gunnery Performance in an Army National Guard Armor Battalion." Research Problem Review 76-9, Army Research Institute, Alexandria, Va., Oct., 1976.

and standards, and also reliable techniques and procedures for conducting measurement. It is only with valid and reliable measurement tools that the training readiness of units can be accurately assessed; compared from one unit to the next; or evaluated over time.

Further investigation into the effectiveness of various individual gunnery training methods, devices, and techniques is also needed. In terms of cost effectiveness, the goal of training is to achieve a maximum performance proficiency level with a minimum expenditure of resources. Currently there is a plethora of tank gunnery training devices and techniques which are being used in the field. A systematic and controlled evaluation of the cost effectiveness of these techniques and devices individually and combined, is needed to determine which ones have training utility and which should be discarded. This type of research is especially relevant to future implementations of the prototype tank crew gunnery training program.

The program consists of a number of training elements which, in order to optimize training efficiency and effectiveness, need to be evaluated individually to determine their relative effect on total program effectiveness.

CONCLUSIONS

1. The Prototype Tank Crew Gunnery Training Program for USAREUR units was successfully implemented in a local training area with limited training resources and terrain. Only minor modifications were required in program design and procedures and these were incorporated during implementation.

2. Training on the Tank Crew Gunnery Training Program was as effective as training conventionally in terms of meeting the current performance standards on Crew Gunnery Table VI; however, both groups met standards on only one-third of the engagements.

3. The conventionally trained group performed better on Table IX platoon gunnery. This may have been due to the fact that their training program contained some platoon level training exercises while the prototype training program was designed only for crew level gunnery.

4. There was no relationship identified between either training experience, duty position experience, or past gunnery performance, and performance on the present gunnery tables.

5. To determine tank gunnery training readiness effectively, further development of valid and reliable performance measures and standards is required.

6. Additional work is needed to evaluate the cost effectiveness of various individual gunnery training techniques and devices and to determine their utility in an overall crew gunnery training program.

APPENDIX A

PROTOTYPE TRAINING PROGRAM DESCRIPTION, IMPLEMENTATION PROCEDURES, AND OBSERVATIONS

The Prototype Tank Crew Gunnery Training Program consisted of six training and evaluation stations. Each station was composed of several parts which required that crew members perform specified tasks, under given conditions, until the performance standard was met.

For clarity, each station will be described separately below. The performance objectives will be presented first, this will be followed by a description of the implementation procedures and support requirements, and finally observations and recommendations will be presented. The training and evaluation score sheets used for each station are also attached.

STATION 1. NO SPECIAL ENVIRONMENT (GUNNER AND TANK COMMANDER)

Part 1. Estimation of Lead on Moving Targets.

Task: Estimate lead from center of mass.

Conditions: Targets are assumed to be traveling at medium speed (13 m.p.h.). Drawings will represent two distances (1000 and 2000 meters), three angles of approach (30°, 60°, 90° from line of sight) for both left and right. (HEAT ammunition is assumed.)

Standards: No more than one error of estimate exceeding 25% of largest lead at that distance. Total time: 60 seconds.

Task: Demonstrate burst-on-target, target form, and mil change methods of adjustment.

Conditions: Four BOT items shall represent the four quadrants, two at 1000 meters and two at 2000 meters. Four "mil change" items shall also represent these quadrants and distances. Four "target form" items will involve drop 1/2 TF, add 1/2 TF, drop one TF, and add one TF; half shall represent a range of 1000 meters, and half 1500 meters. (Total, 12 items.)

Standards: 11 out of 12 within one mil tolerance.

SUPPORT REQUIREMENTS:

Personnel: 1 Station Administrator

1 Assistant

Equipment: 1 loose leaf binder

12 document protectors with reticle drawn to scale

6 paper inserts with drawings depicting tank targets at 1000 m distance and angles of approach of 30, 60 and 90° respectively both left and right

6 paper inserts with drawings depicting tank targets at 2000 m and angles of approach of 30, 60 and 90° respectively both left and right

2 each document protectors with sight reticle for individual use when applying adjustment of fire techniques

4 each grease pencils

PROCEDURES:

Tank Commanders and Gunners trained individually on the two tasks in this station. The first task required the crew member to use the sight reticle to estimate the correct lead for a variety of moving targets. A scaled drawing of a tank target was inserted into a plastic document protector. The face of the document protector contained a scaled drawing of the M-32 sight reticle centered on the target. The instructor described the target conditions and the crew member moved the tank drawing until the reticle was placed in position for the correct lead. The procedure was followed for all target situations. When errors in estimating lead occurred frequently, appropriate remedial instructions were given.

The second task required crew members to use burst-on-target, target form, and mil change methods of adjustment to score a second round hit on a simulated target. Again scaled drawings of tank targets and sight reticles were used. The instructor drew the initial strike of the round on the face of the document protector and indicated the method of adjustment to be used. The crew member then moved the target until the sight reticle was in the correct position for a second round hit. The procedure was followed for all adjustment techniques with remedial instruction being given as necessary. Each task required approximately 30 minutes per crew member to complete.

OBSERVATIONS:

Both tasks proved to be more difficult than originally anticipated. Crew members had difficulty using the mil relations on the sight reticle and frequent remedial instructions were required. The mil change method of adjustment was particularly difficult. In talking with instructors, the impression obtained was that gunners use target form adjustments most frequently and very little formal training is given concerning sight reticle mil relations as they pertain to moving targets or fire adjustment.

Two modifications were made to the task standards. The standard on the first task was modified from the original to read "No more than one error out of one try at each of the target distances." The standard on task two was changed from a one mil error tolerance to a 1/2 mil error tolerance.

RECOMMENDATIONS:

The tasks on station one need special emphasis because of apparent problems in reading the sight reticle properly. The Handbook For Sight Picture Training, developed recently by ARI, looks like a valuable training aid for the tasks required in this station and should be incorporated for future training.

STATION
ADMINISTRATOR

STATION I

UNIT_____ TANK #____

TC_____ GNR_____

PART I

TASK/CONDITION I	STANDARDS	SCORING	REMARKS
Estimate lead from center of mass. 12 Tgts assumed to be at medium speed (13 m.p.h.) Targets represent two distances 1000 and 2000m three angles of approach 30°, 60°, 90°, from line of sight	No more than one error out of one try at each distance.	# CORRECT 1000 2000 30° L R 60° L R 90° L R	

PART II

TASK/CONDITION I	STANDARDS	SCORING	REMARKS
Demonstrate BOT, target form, and mil change methods of adjustment. Four Burst-On-Targets, two at 1000m and two at 2000m. Four mil change Tgts ar 1000m & 2000m. Four target form targets, two at 1000m two at 1500m.	11 out of 12 within one mil tolerance	# CORRECT B.O.T. MIL CHAN. TGT FORM	

STATION II. STATIONARY TANK (GUNNER AND TANK COMMANDER)

Part 1. Aiming, Stationary Targets

Task: Aim main gun at stationary tank targets (40).

Conditions: Each target within infinity sight when reticle is on previous target. Direction of adjustment from previous target will include up, down, left and right in approximately equal proportions, in random order. Aiming point indicated by dot.

Standards: Accuracy, 38 out of 40 within tolerance oval (one mil high, 1.5 mils wide, centered on aiming point). Time, three seconds per target, average. All targets approached upward, 36 out of 40 with no overshooting.

Part 2. Tracking Moving Targets

Task: Gunner tracks and fires at moving targets.

Conditions: Tank target moving at medium speed (13 mph scale) crossing obliquely (about 5^{o} from the horizontal). Of 30 targets, 10 shall move downward left, 10 downward right, 5 upward left, and 5 upward right. (HEAT ammunition is assumed.)

Standards: 25 out of 30 within tolerance oval 2 mils high, 4 mils long, centered on correct point of aim.

Part 3. Range Card Data

Task: Apply range card data.

Conditions: Range card with representative data.

Standards: Data correctly applied within 25 seconds.

SUPPORT REQUIREMENTS:

Personnel: 1 Station Administrator

2 Assistants

2 Individuals to operate pulley system

Equipment: 2 tanks with radios and equipment

2 M-55 lasers, one to be mounted for each main gun

1 target board with reflective surface and 40 each threat targets drawn to scale on same

1 pulley system

1 scaled threat target 1/60 to be attached to pulley system

PROCEDURES:

The first task required the crew member to correctly aim the main gun at a series of stationary targets. An M60 A1 tank was positioned 55 ft. in front of a large plywood board simulating a tank-to-target distance of 1000 meters at 1/60 scale. Tank target silhouettes (1/60 scale) were cut from reflective tape and mounted to the board to form two rows of 20 targets each. Each row was arranged to form roughly a sinusoid pattern. Targets were spaced so that the succeeding target was in the sight picture when the preceding target was being aimed at. An M55 laser was boresighted to the main gun and the crew member aimed the gun at the target and fired the laser. The instructor timed the total exercise with a stop watch, counted the targets hit, and checked that all final aiming adjustments were made in an upward direction. Total time was divided by the number of targets to get an average target engagement time.

For task 2 a 1/60 scale target was attached to a hand operated pulley system which moved the target in an oblique line in front of two stationary tanks simulating a distance of 1000 meters. The two tanks were positioned at particular angles so that by using one tank, left downward and upward angles of approach were provided, while the other tank provided right downward and upward angles of approach. The crew member tracked the target as it moved along the pulley system and fired at it using the M55 laser.

In task 3 the crew member was given representative range card data and he had to position the main gun to the specified azimuth and elevation settings.

OBSERVATIONS:

Crew members expressed the opinion that all three tasks were valuable training exercises which emphasized some important gunnery skills. Two problems were encountered. On task 1 it was difficult to boresight the laser to the main gun because of parallax problems. This problem was partially overcome by using only one row of targets and engaging that row twice. When two rows were used the laser had to be boresighted separately for each row. In task 2 it was difficult to get standardized and smooth target movement using the hand operated pulley system. This problem was never totally resolved given the equipment available. Finally, the standard of three seconds per target engagement on task 1 was found to be too short, therefore the standard was changed to an average of four seconds per target.

RECOMMENDATION:

When using a series of 1/60 scale targets it is important to have all the targets in relatively the same plane to minimize parallax problems. A motor driven moving target device needs to be developed to provide uniform and smooth target moving during tracking tasks.

When using the laser to fire at moving targets a delay circuit should be built into the trigger mechanism so that target lead can be properly simulated.

STATION II

STATION ADMINISTRATOR_____

UNIT_____ TANK #____

TC_____ GNR _____

PART I

TASK/CONDITION I	STANDARDS	SCORING	REMARKS
Engage 40 Scale Tank Drawings simulating 1000m. Gunner Fires on a line of connected targets with each target within the infinity sight as previous target is engaged.	38 out of 40 tgts hit within tolerance eval (one mil high by 1.5 mils wide). All targets approached upward, 4 secs per target average 38 of 40 no overshooting	OPEN | CLOSE # TGT HITS	# of Correct Lays

PART II

TASK/CONDITION I	AMMO	STANDARDS	SCORING	REMARKS
Engage 30 Tanks moving at approximately 13 m.p.h. 10 moving downward left, 10 downward right, 5 upward left, and 5 upward right.	1 Rds HEAT Per Tgt (Simulated)	25 out of 30 within tolerance eval 2 mils high, 4 mils long.	# TGT HITS	

PART III

TASK/CONDITION I	STANDARDS		REMARKS
Given a Range Card Correctly apply representative data.	Data Correctly Applied within 25 seconds.	START FINISH	

STATION III. FULL SCALE RANGE (NON-FIRING)

Part 1. Target Acquisition

Task: Detect targets and record location.

Conditions: Two target groups, five targets each group, are exposed for 40 seconds each. TC may assign search sectors to crew members in any tactically realistic manner.

Standards: 8 out of 10 targets detected and recorded. Crew is credited with any target that one or more crew members record.

Part 2. Ranging (Using Rangefinder)

Task: TC determines range to targets with rangefinder.

Conditions: 20 targets at ranges of 1000-2000 meters.

Standards: Average error, 50 meters or less. Average time per target, four seconds from the time TC announces he is ready until adjustment is complete.

Part 3. Rough Lay of Main Gun

Task: TC lay main gun (approximately).

Conditions: Each target indicated. Each target displaced 5-30° in azimuth, 3-15° in elevation from previous target, with direction random.

Standards: Fifteen out of 20 targets have some part in the circle of the infinity sight. Performance begins when TC starts to slew gun tube. Three seconds per target, average.

SUPPORT REQUIREMENTS

Personnel: 1 Station Administrator

1 Driver/Radio Operator

2 Wheeled Vehicle Drivers/Radio Operators

Equipment: 1 tank with radios

binoculars

1 wheeled vehicle with radios

50 target panels simulating BMP, BRDM's, T-62 tanks

1 boresight panel at 1200 meters

PROCEDURES:

Task 1 required the participation of all crew members while tasks 2 and 3 were tank commander tasks. Approximately 50 half scale targets were randomly placed in sets of five each throughout a given search sector. Targets represented BRDMs, BMPs, and T-62 tanks and were positioned to simulate distances from 1000 to 2000 meters. All targets were hidden from view initially and were raised in two sets of five each on the station administrator's command. All crew members were instructed to search the area and to locate and identify targets as they were acquired. The instructor radioed his assistants in the field when targets were to be raised and recorded target acquisition data. Multiple targets were attached to ropes so that one man could usually raise several targets at one time.

After task 1 was completed the instructor briefed the tank commanders on the requirements for tasks 2 and 3. The boresight panel was then used to check the accuracy of the rangefinder. For the rough lay of the main gun task the instructor called up a target and slewed the main gun in a random direction away from the target. The controls were then turned over to the TC who had to lay the gun back on the target. The instructor checked the accuracy of the lay and recorded the time. Using the same target, the TC then determined the range to the target using the range finder. All targets used for ranging were at measured distances so that the instructor could score each one accurately.

OBSERVATIONS AND RECOMMENDATIONS:

Presenting tactically realistic target arrays is difficult in training areas where terrain is constricted and lacking in natural terrain features. Depending on terrain availability, compromises will have to be made between the scale of the targets presented and the tactical realism of the presentations. Using targets smaller than 1/20 scale should probably be avoided for these tasks. If possible, automatic target lift mechanisms such as the SAAB devices should be used for target presentation, however these devices are probably not available at most LTA's. Finally, again depending on terrain availability, maximum dispersion of targets in both depth and width should be achieved.

STATION III

STATION ADMINISTRATOR _____

UNIT _____ TANK # ____

TO _____ GUN _____ LDR _____ DR _____

PART I

TASK/CONDITION I	STANDARDS	SCORING	REMARKS
2 sets of 5 tgts presented the crew must detect and record locations of tgts. Each set presented for 40 sec each.	8 out of 10 tgts detected and recorded.	Tgts detected and recorded.	

PART II

TASK/CONDITION I	STANDARDS	SCORING	REMARKS
TC determines range to 20 tgts by using the range finder, tgts are at 1000 to 2000m	Average error 50m or less average time 4 sec per tgt.	Average Error Average Time	RECORD ERROR INDIVIDUALLY THEN CALCULATE AVERAGE

PART III

TASK/CONDITION I	STANDARDS	SCORING	REMARKS
TC Lays main run on 20 tgts in a random direction indicated by Station administrator. Displaced 5-30° Azimuth 3-15° in elevation	15 out of 20 tgts have some part in the circle of the infinity sight.	# of tgts correctly layed on 3 sec average	

STATION III SCORE SHEET (Continued)

TGT ACQUISITION	RANGING TGT #	READING RANGE FINDER	ACTUAL DISTANCE	LAYING DIFF.	MAIN GUN
1	1				1
2	2				2
3	3				3
4	4				4
5	5				5
6	6				6
7	7				7
8	8				8
9	9				9
10	10				10
	11				11
	12				12
	13				13
	14				14
	15				15
	16				16
	17				17
	18				18
	19				19
	20				20

STATION IV. SUBCALIBER (1/60 SCALE)

Part 1. Daytime Engagements

Task 1: Engage multiple machine gun targets (troops, BRDM) with both the coax and the cal. 50 during daylight. (Not simulated on 1/60 scale ranges.)

Task 2: Engage multiple (2) moving tank targets with the main gun during daylight.

Conditions:

(1) Targets. One tank panel (flank) moving perpendicular to the line of sight. One tank panel (frontal) moving directly toward or away from firing tank. Both concealed before engagement, with movement started simultaneously. Range 1100-1400 meters, speed 10-15 mph.

(2) Ammunition. 3 rounds allocated.

(3) Initiation of engagement. Upon command of platoon leader, or activation of pop-up target.

Standards for each engagement:

(1) Time. Open within 8 seconds.

(2) Effect. Both targets hit.

Task standard: Two successful engagements out of three.

Task 3: Engage multiple (2) tank targets with the main gun and one BRDM with cal. 50 during daylight.

Conditions:

(1) Targets. One tank panel (frontal) at 1400 meters. One tank panel (frontal) at 1900 meters. One truck (without missile capability) at 700 meters. The truck is to be engaged as a dry firing exercise with the cal. 50 in conjunction with engagement of the other targets. All targets will be concealed prior to engagement.

(2) Ammunition. 3 rounds allocated.

(3) Initiation of engagement. Upon command of platoon leader or activation of pop-up target.

Standards for each engagement:

(1) Time. Open within 8 seconds.

(2) Effect. All targets hit.

Task standard: Two successful engagements out of three.

Part 2. Night Engagements

Task 1: Engage one stationary tank target with the main gun utilizing the range card to direct lay technique, at night under direct white searchlight illuminations.

Conditions:

(1) Target. One tank panel (frontal) selected from seven or more, distributed at ranges of 1000-1200 meters. These will be represented on prepared range card.

(2) Ammunition. 2 rounds allocated.

(3) Firing tank moved into prepared, staked position prior to engagement.

(4) Initiation of engagement. Preparatory phase (in which data are applied to the fire control system) is initiated when prepared data for one target is given and upon command. (After the data are applied to the gun, the TC reports to the platoon leader.) The engagement itself is initiated when searchlight is turned on the target tank.

(5) Other. All hatches will be closed and crew members will wear protective masks 30 seconds prior to and during engagement.

Standards for each engagement:

(1) Time. Data applied within 25 seconds. Open within 5 seconds of illumination.

(2) Effect. Target hit.

Task standard: Five successful engagements out of six, with two first round hits.

Task 2: Engage one stationary tank with the main gun, utilizing the range card to direct lay technique, at night under direct IR searchlight illumination.

Conditions:

(1) Target. One tank panel (frontal) selected from seven or more, distributed at ranges of 1000-1200 meters. These will be represented on prepared range cards.

(2) Ammunition. Two rounds main gun for each engagement.

(3) Firing tank moved into prepared, staked position prior to engagement.

(4) Initiation of engagement. Preparatory phase (in which data are applied to the fire control system) is initiated when prepared data for one target are given and upon command. (After the data are applied to the gun, the TC reports to the platoon leader.) The engagement itself is initiated when IR light is turned on the target tanks.

Standards for each engagement:

(1) Time. Data applied within 25 seconds. Open within 5 seconds of IR illumination.

(2) Effect. Target hit.

Task standard: Five successful engagements out of six with two first round hits.

Task 3: Engage multiple machine gun targets (troops, BRDM) with both the coax and the cal. 50 at night. (Not simulated on 1/60 scale ranges.)

Task 4: Engage multiple (2) moving targets with the main gun at night.

Conditions:

(1) Targets. One tank panel (flank) moving perpendicular to the line of sight. One tank panel (frontal) moving directly toward or away from firing tank. Both at 1100-1400 meters, speed 10-15 mph under direct illumination by searchlight.

(2) Ammunition. 3 rounds allocated.

Task standard: Two successful engagements out of three.

SUPPORT REQUIREMENTS:

Personnel: 1 Station Administrator

1 Assistant Administrator

2 Assistants to operate pulley system and raise pop-up scaled 1/60 tank targets.

Equipment: 1 tank with radios and on board equipment for use in engagements

1 tank with radios and on board equipment to supply power and to raise pop-up targets

1 1/60 scale mini tank range

2 M55 laser devices for coax and 50 cal.

1 Brewster device for main gun

.22 cal. ammo.

20 scaled troop targets with reflective surface

4 scaled BRDM targets with reflecting surface

12 pop-up SAAB devices for scaled tank targets

2 scaled tank targets for moving tank engagements

PROCEDURES:

All tasks in Station IV were conducted using the mini-tank range facilities at the LTA. Two M60 Al tanks were placed on line in front of the mini-tank range facility. One tank applied electrical power for the target pop-up devices while the second tank was used by the gunner and TC to perform the tasks. Threat targets were simulated with 1/60 scale target devices. Main gun engagements were simulated with the Brewster device and cal. 22 firing while machine gun engagements were simulated with the M55 laser devices.

OBSERVATIONS:

Station IV proved to be the most difficult station both in terms of administration and execution. The mini-tank range facility used did not meet the original specifications for a scaled range in terms of the required distance from tank to targets. The range was approximately 50 ft. too short thus increasing the problems of parallax which already exist on properly scaled ranges. Attempts had been made to have the range rebuilt to meet specifications but this had not been accomplished at the time training was conducted. Because of the parallax problems task 2 (multiple moving tanks) was deleted. Because of the lack of training time and also because of equipment problems, the night engagements in Station IV were also deleted. For the day engagements the original standards for each engagement called for two successful engagements out of three on some of the tasks. This standard was modified to one successful engagement primarily because of limited training time.

Problems with training equipment occurred fairly frequently during the course of the training with malfunctions of the Brewster device being one of the more common.

RECOMMENDATIONS:

Tank gunnery training on mini-tank ranges requires a great deal of prior preparation to properly set up the range and to test the equipment. Worthwhile training can only be achieved if the facilities, devices, and equipment are available and maintained properly. Parallax problems are inherent to 1/60 scale ranges and thus alternatives to this range should be sought. One alternative might be a moving target screen which already exists at some LTA's. By having the targets projected on a screen the real target-to-tank distance remains constant thus eliminating some of the parallax problems.

STATION IV
SCORE SHEET

STATION
ADMINISTRATOR_____

TANK NUMBER_____

UNIT_____

DAYTIME ACTIVITIES

TASK/CONDITION	AMMG	STANDARDS	SCORING		RATING	
			TIME	SCORING		
1. Engage multiple machine gun tgts (troops, BRDM) with both the coax and 50 cal during daylight	50 Cal Coax (simulated with M55 laser)	Time Alloted: Open within 8 secs Standard: Target Hit	Open Close	ENG. 1	2	3
2. Engage multiple (2) moving tank tgts with the main gun during daylight	3 rds .22 Cal used as sabot in Fire Command	Time Alloted: Open within 8 secs. 2 successful engagements out of 3. Successful engagement is both targets hit.	TIME Open Close	SENSING 1 2 3	SENSING 1 2 3	SENSING 1 2 3
3. Engage multiple (2) Tank tgts with the main and one BRDM with 50 Cal during daylight NOTE: The truck is a dry run exercise.	3rds .22 Cal used as sabot in Fire Command	Time Alloted: Open within 8 secs 2 out of 3. Both targets hit per successful engagement	TIME Open Close	SENSING # 1 1 2 3	SENSING # 2 1 2 3	SENSING # 3 1 2 3

NIGHT ENGAGEMENTS

	AMMG	STANDARDS	SCORING	RATING
4. Engage one stationary tank target with the main gun utilizing range card to direct lay technique under direct white light illumination. CBR Conditions in Effect	2 Rds 22 Cal Per Tgt Engaged	Time Alloted: Data applyed within 25 secs Open within 5 secs of illum. per target. Target hit. Five successful engagements out of six. Two first round hits.	TIME: Open / Close SENSING: 1 2 / 3 4 / 5 6 / 7 8 / 9 10 / 11 12	
5. Engage one stationary tank tgt with main gun utilizing range card to direct lay technique under IR illumination	2 Rds 22 Cal Per Tgt Engaged	Time Alloted: Data applyed within 25 secs open within 5 secs of illum. per target. Target hit. Five successful engagements out of six. Two first round hits.	TIME: Open / Close SENSING: 1 2 / 3 4 / 5 6 / 7 8 / 9 10 / 11 12	
6. Engage multiple machine gun tgts (Troops BRDM) with both coax & 50 cal.	Coax 50 Cal. Simulated with M55 laser	Time Alloted: Open within 8 secs. 2 out of 3	TIME Open Close SENSING: #1 #2 #3	
7. Engage (2) moving tanks with main gun at night with white light	3 Rds	Time Alloted: Open within 8 secs. 2 out of 3	TIME Open Close SENSING: #1 #2 #3	

STATION V. MOVING TANK FACILITY

Task 1. Load main gun five times (unload between).

Conditions: Dummy round, open breech, stationary tank.

Standards: 30 seconds

Task 2. Main Gun: Immediate action.

A dummy round is needed.

Subtask: Apply three triggers, rotate the round and attempt to fire again.

Conditions: Assume initial misfire, no hot tube.

Standards: 15 seconds.

Task 3. Caliber .50: Immediate action.

Subtask: TC will recharge weapon and attempt to fire it.

Conditions: Assume weapon does not fire.

Standards: 5 seconds.

Task 4. Coax Machine Gun: Immediate action.

Subtask 1: Loader will recharge weapon and gunner will try again to fire it.

Conditions: Assume stoppage.

Standards: 5 seconds.

Subtask 2: Secondary corrective action. Loader will charge the weapon, lift the cover, check the feed tray, use extraction tool to remove jammed round, close cover. Gunner will try again to fire it.

Conditions: Immediate action (above) does not reduce stoppage because of jammed round.

Standards: 25 seconds.

Subtask 3: Change barrels. Loader will change barrels on the coax.

Conditions: Assume that above actions do not remove stoppage or that there is a hot barrel.

Standards: 5 seconds.

Subtask 4: Loader will disassemble and assemble the coax machine gun, locating any malfunction.

Conditions: Assume coax that does not fire and does not clear with recharging and attempted refire.

Standards: 4 minutes.

Task 5: Driver Tactical Response

Subtask: Driver responds to commands for the eight engagements of Table VIII according to a pre-arranged schedule. On two engagements he will utilize available defilade.

Conditions:

(1) Verbal command to gunner.

(2) Pre-arranged responses.

(3) Defilade available for two engagements.

Standards: Correct and timely responses.

SUPPORT REQUIREMENTS:

Personnel: 1 Station Administrator

3 Assistant Administrators

Equipment: 3 dummy main gun rounds

3 belts of dummy coax rounds

3 belts of dummy .50 cal rounds

individual tank crews with radios and equipment on board, including coax and .50 cal machine guns

PROCEDURE:

The objective of Station IV was for each crew member to perform specified tasks while the tank was moving or stationary. Most of the tasks involved immediate action on the weapons systems and required the coordinated activity of several crew members. The sequence of activity was as follows: The crew received their briefing, then loader conducted loading of main gun five times while the tank was stationary. He used a dummy round and was

timed from the moment the fire command was completed until he said "up." He was not timed while removing the round from tube. The tank was then told to move out and the TC was instructed to give a fire command and assume misfire. The gunner applied three triggers and the loader rotated the round and attempted to fire again. Timing started when the misfire was announced and ended after the round was rotated and final attempt to fire was made. The tank commander was then told to assume he was conducting an engagement from his position with the cal. 50 and the weapon stopped. Timing started when the administrator said "go" and stopped when TC had recharged weapon and attempted to fire again. The TC was then told to give a fire command requiring the gunner to engage troops with the coax machine gun. During this simulated engagement the gunner indicated a stoppage and both gunner and loader went through the immediate action subtasks in task 4. Each subtask was timed separately.

The final task required the driver to respond correctly to tactical commands given by the TC. These commands consisted primarily of responding to fire commands while on the move and seeking defilade firing positions.

OBSERVATIONS AND RECOMMENDATIONS:

Overall, the training on this station went very smoothly and presented few problems. To comply with current procedures, task 2, main gun, immediate action procedures should be changed to read as follows:

1. try three triggers
2. try blasting machine
3. wait 2 minutes
4. spin round 180 degrees
5. try one trigger.

STATION V

STATION ADMINISTRATOR _____

UNIT _____ TANK #____

TC_____ GUN_____ LDR_____ DR_____

PART I

TASK/CONDITION I	STANDARDS	SCORING		REMARKS
		Sat.	Unsat.	
Loader must load main gun.	Load main gun 5 times in 30 seconds.			

PART II

TASK/CONDITION I	STANDARDS	SCORING		REMARKS
		Sat.	Unsat.	
Immediate action - main gun. Apply three triggers, loader rotate round runner, again trys to fire main gun. Assume initial misfire, no hot tube.	Perform correctly 15 seconds.			

PART III

TASK/CONDITION I	STANDARDS	SCORING		REMARKS
		Sat.	Unsat.	
TC assumes stoppage of 50 cal. TC will recharge weapon and try to fire it again	TC has 5 seconds to recharge weapon and attempt to fire it.			

PART IV

TASK/CONDITION I	STANDARDS	SCORING		REMARKS
		Sat.	Unsat.	
Gunner assumes stoppage on M240. Loader recharges weapon. Gunner attempts to fire again.	Reduce stoppage within 5 seconds.			

STATION V (Continued)

PART IV (Continued)

TASK/CONDITION II	STANDARDS	SCORING		REMARKS
		Sat.	Unsat.	
Recharging weapon does not reduce stoppage. Loader must charge weapon, lift cover, check food tray, use extraction tool to remove jammed round, close cover.	Accomplish task within 25 seconds.			

TASK/CONDITION III	STANDARDS	SCORING		REMARKS
		Sat.	Unsat.	
Weapon still does not fire. Loader will change barrels on the M240 machine gun.	Change barrel within 40 seconds.			

TASK/CONDITION IV	STANDARDS	SCORING		REMARKS
		Sat.	Unsat.	
Loader assumes coax will not fire or will not clear with recharging and attempted refire. Loader disassembles and assembles weapon locating any malfunction.	Weapon must be disassembled and assembled within 2-1/2 minutes.			

PART V

TASK/CONDITION I	STANDARDS	SCORING		REMARKS
		Sat.	Unsat.	
Driver responses to commands for eight engagements to include 2 defilade positions. Driver will react to verbal commands to gunner, prearranged commands and select defilade positions.	Correct and Timely responses.			

STATION VI. MOVING TANK RANGE

The purpose of this activity was to repeat the engagements in Station IV using the largest scale range available at the LTA. The M55 laser was to simulate main gun firing and the firing tank was required to move between engagements.

SUPPORT REQUIREMENTS:

Personnel: 1 Station Administrator

2 Assistant Administrators

2 Individuals to operate pulley system and pop-up targets

Equipment: 1 tank with radios and on board equipment

2 lasers (M55)

cal .50 MG

coax MG

5 scaled tank targets with reflecting surface

2 BRDM scaled targets with reflecting surface

1 scaled ATGM position with reflective surface

1 scaled RPG position with reflective surface

2 sets of infantry scaled targets with reflective surfaces

PROCEDURES:

Rather than repeat the tasks contained in Station IV, the engagements in this station were designed the same as the engagements found in the Table VI criterion test. The attached score sheet describes each engagement. All engagements used 1/20 scale targets and two M55 lasers to simulate firing. One laser was boresighted to the coax and main gun and the second laser was boresighted to the cal .50. The entire crew participated in each engagement with the scenario requiring that the tank move approximately 75 meters between engagements.

An assistant instructor rode on each tank as it negotiated the course. The AI presented the scenario and scored performance.

OBSERVATIONS AND RECOMMENDATIONS:

Crews overall felt that the training on this station was much more realistic than the mini-tank range. The larger scale targets probably contributed to this effect. The only significant problems on the station involved the moving targets which were difficult to control in terms of movement speed and consistency. Again a hand operated pulley system wás used which was not always reliable. Training on this station should continue to use the largest targets available at the LTA.

UNIT _____

TANK # _____

STATION
ADMINISTRATOR _____

STATION VI

TASK	CONDITIONS: TARGET/SITUATION	CONDITIONS: AMMO	STANDARDS: ALL TARGETS HIT	STANDARDS: CREW DUTIES	STANDARDS: MACHINEGUN COVERAGE	STANDARDS: TIME	STANDARDS: RATING
1. Engage a stationary tank from TC position with main gun.	1 Threat stationary tank, 1,400-1,600m.	2 TPDS-T	YES	NO		0-11 sec. 12-16 sec. 17 + sec.	D Q U
2. Engage multiple moving tanks with main gun.	2 Threat moving tanks, 1,200-1,600m.	4 TPDS-T	YES	NO		0-18 sec. 19-30 sec. 31 + sec.	D Q U
3. Engage infantry squad and BRDM with machine-guns, simultaneously.	NBC environment, hatches closed, 1 infantry squad 800-900m, 1 moving BRDM 900-1,100m.	100 COAX 50 Cal. 50	YES	NO	3/5,4/5,5/5 2/5 1/5 or 0/5	0-12 sec. 13-30 sec. 31 + sec.	D Q U
4. Engage multiple stationary tanks with main gun.	3 Threat tanks, 800-1, 100m.	5 HEAT-TIT	YES	NO		0-26 sec. 27-40 sec. 41 + sec.	D Q U
5. Engage infantry squad and moving truck with machineguns simultaneously.	1 Infantry squad and 1 moving truck 800-1, 000m, NBC environment.	100 COAX 50 Cal. 50	YES	NO	3/5, 4/5, 5/5 2/5 1/5 or 0/5	0-12 sec. 13-30 sec. 31 + sec.	D Q U
6. Engage RPG team, ATGM team, and infantry squad with machine-guns simultaneously.	Threat RPG team, 200-400m. ATGM team, 700-900m. Infantry squad, 1,200-1,600m.	100 COAX 50 Cal. 50	YES	NO	3/5, 4/5, 5/5 2/5 1/5 or 0/5	0-18 sec. 19-40 sec. 41 + sec.	D Q U

APPENDIX B

TANK CREW: TC:_____ TABLE VIA SCORECARD Date:_____

GR:_____

DR:_____ TANK #_____

LD:_____

TASK	TARGET/SITUATION	AMMO	ALL TARGETS HIT	CREW DUTIES	STANDARDS MG COVERAGE	TIME	RATING
1. Engage a stationary tank from TC position with main gun.	1 Threat stationary tank, 1400-1600m.	2 HEAT-TPT	YES NO			0-11 sec 12-16 sec 17+ sec	GREEN AMBER RED
2. Engage multiple moving tanks w/main gun.	2 Threat moving tank 1200-1600m.	4 HEAT-TPT	YES NO			0-18 sec 19-30 sec 31+ sec	GREEN AMBER RED
3. Engage Inf Sqd & BRDM with machine guns simultaneously.	NBC environment, hatches closed, 1 Inf Sqd 800-900m, 1 moving BRDM 900-1100 meters.	100 Coax 50 Cal (50)	YES NO		3/5 4/5 5/5 2/5 1/5 or less	0-12 sec 13-30 sec 31+ sec	GREEN AMBER RED
4. Engage multiple stationary tanks with main gun.	3 Threat tanks from 800-1100 meters.	5 HEAT-TPT	YES NO			0-26 sec 27-40 sec 41+ sec	GREEN AMBER RED
5. Engage Inf Sqd & moving truck w/MG's simultaneously.	1 Inf Sqd & 1 moving truck 800-1100m. NBC environment.	100 Coax 50 Cal (50)	YES NO		3/5 4/5 5/5 2/5 1/5 or less	0-12 sec 13-30 sec 31+ sec	GREEN AMBER RED
6. Engage RPG Team, ATGM Team, & Inf Sqd with machine guns, simultaneously	Threat RPG Team 200-400 meters. ATGM Team 700-900m. Inf Sqd 1200-1600m.	100 Coax 50 Cal (50)	YES NO		3/5 4/5 5/5 2/5 1/5 or less	0-13 sec 19-40 sec 41+ sec	GREEN AMBER RED

TABLE VI STANDARDS: GREEN: Obtain a distinguished rating on 5 - 6 tasks.
AMBER: Obtain a distinguished or qualified rating on 4 of 6 tasks.
RED: Receive unqualified ratings on 3 or more tasks.

TABLE VI SCORE SHEET

Tank Number_____ TC_____

Company_____ Gunner_____

Battalion_____ Loader_____

Driver_____

Engagement	Scores
1.	Time for first round_____
	Rounds to first hit_____
	Time to first hit_____
	# targets hit_____
	Total rounds fired_____
	Total engagement time_____
2.	Time for first round_____
	Rounds to first hit_____
	Time to first hit_____
	# targets hit_____
	Total rounds fired_____
	Total engagement time_____
3.	Time for coax to open_____
	Time for 50 cal to open_____
	Total engagement time_____
	Coax coverage_____
	50 cal coverage_____
	Target handoff sat_____unsat_____

Engagement	Scores
4.	Time for first round_____
	Rounds to first hit_____
	Time to first hit_____
	# targets hit_____
	Total rounds fired_____
	Total engagement time_____
5.	Time for coax to open_____
	Time for 50 cal to open_____
	Total engagement time_____
	Coax coverage_____ _____
	50 cal coverage_____
	Target handoff sat_____unsat_____
6.	Time for coax to open_____
	Time for 50 cal to open_____
	Total engagement time_____
	Coax coverage_____
	50 cal coverage_____
	Target handoff sat_____unsat_____

TANK TABLE VIIIC (A) MULTIPLE BATTLE RUN SCORECARD (DAY)

UNIT _____ DATE _____ SCORE _____

TASK	CONDITIONS/SITUATION	AMMO	MAIN GUN HITS 70%	CREW DUTIES	MACHINE GUN COVERAGE	TIME / RATING SECONDS
1. Engage 2 moving tanks 3 groups of dismounted Infantry.	Moving tanks, 1200-1600 meters. NBC environment hatches closed, indirect fire.	NACCA	Yes No PHASE LINE RED	Yes No	2 of 3 groups dismounted Infantry. Yes No	0 - 18 Sec. - G 19 - 40 Sec. - A 40+ Sec. - R
2. Engage ATGM's, 2 groups of dismounted Infantry - 2 each BRDM's	Suppress ATGM (1000-1400 meters). Hit 2 out of 3 groups.	Cal..50 (85) COAX		Yes No	Yes No PHASE LINE RED Suppress Troops SUP. ATGM	0 - 18 Sec. - G 19 - 40 Sec. - A 40+ Sec. - R
3. Engage 3 frontal Tanks simultaneously (STAL MODE)	Destroy 3 tanks (800-1600 meters), Simultaneously SHIFT indirect fire, Reports.	8 NACCA	Yes No PHASE LINE BLUE	Yes Nc		0 - 20 Sec. - G 21 - 40 Sec. - A 41+ Sec. - R
4. Engage 9 OPFOR tank company.	Destroy 7 of 9 tanks Range 1000-1400 meters, Reports.	18 NACCA	Yes No OBJ. WHITE	Yes No		0 - 20 Sec. - G 21 - 40 Sec. - A 41+ Sec. - R
5. Engage 2 ATGM's, 2 HIND helicopters.	Destroy both ATGM's (1000-1600 meters). 2 HIND's (1000-1600 meters), Reports	M-85 Cal..50 COAX		Yes No	Sup. ATGM Hit both HIND helicopters. OBJ. WHITE	0 - 18 Sec. - G 19 - 40 Sec. - A 41+ Sec. - R

TANK CREW: TC:_____ GR:_____ DR:_____ LD:_____

TABLE VIII MULTIPLE TANK BATTLE RUN
SET A: DEFENSE-LIVE FIRE-DAY

Date:_____

TANK #_____

TASK	CONDITIONS	STANDARDS 70%	TARGET	HITS	ELAPSED TIME	AMMO	REMARKS
1. Engage OPFOR (BP ARROW)	Arty Fire on Platoon Position, using Main Gun & Machineguns, Engage: 9(6) Frontal Tanks, 1200-1500m.	6	YES	NO	0-40 sec Q 41+ sec U	18 HEAT-TPT	
	2(1) Sagger Surpression Targets, 1000-1400m-Suppress Each Sagger	2	YES	NO	0-40 sec Q 41+ sec U	150 50 Cal	
MOVE TO BP FINDER							
2. Engage OPFOR while moving.	Using Main Gun, Engage using STAB mode: 3(2) Frontal Tanks, 1400-1600m	2	YES	NO	0-40 sec Q 41+ sec U	6 HEAT-TPT	
3. Engage OPFOR (BP PATH)	Arty Fire on Platoon Position, TM Co Reports GAS, using Main Gun and Machineguns, Engage: 4(2) Moving Tanks & 2 (1) HINDS (NACCA) 1200-1600m.	4	YES	NO	0-40 sec Q 41+ sec U	8 HEAT-TPT 10 NACCA	
	3(2) ATGM & Inf Tms, 3(2) Sagger Surpression Targets, 1000-1400m	4	YES	NO	0-2m 40 sec Q 2m 41 sec+ U	150 50 Cal	
TOTAL:	TARGETS Main Gun 18 M-85 5 COAX 3 26 TOTAL TARGETS	STANDARDS 70% 18	YES	NO		AMMUNITION SECT / TANK 32 HEAT-TPT 6(7) 300 M-85 100 150 COAX 50 10 NACCA 2	

ADDITIONAL REMARKS

SCENARIO - TABLE IX
DAY - ARMOR

EVENT #	ACTION
1.	Firing platoon occupies B.P. path.
	a. Displays green flag - proceeds to path.
	b. At B.P. path:
	(1) Identifies range fan markers - reports.
	(2) Performs safety/prep to fire checks.
2.	Permission to go WET granted.
	a. Displays red flag.
	b. Load NACCA - zero confirmation.
	c. Reports when complete.
3.	Receiving heavy pressure from two enemy tank companies to your front. Engage on sight.
	a. First NACCA engagement - 10 tanks. (One minute after first engagement).
	b. Second NACCA engagement - 10 tanks.
4.	Both sections instructed to:
	a. Clear NACCA's
	b. Display green flag.
5.	Platoon Leader instructed to reposition one section to B.P. finder due to increased enemy pressure.
	a. One section moves out.
	b. Shortly after 1st section moves out Platoon Leaders informed of unknown chemical agent detected downwind of B.P. path.
	c. Both moving and stationary sections take protective measures and report.

SCENARIO - TABLE IX
DAY - ARMOR

EVENT #	ACTION
6.	Platoon Leader moves other section as soon as first section nears B.P. finder.
7.	Both sections set on B.P. finder. a. All elements identify range fan markers. b. All crew served weapons loaded (HEAT-TPT). c. Display red flag. d. Platoon reports ready.
8.	Intel indicates that an antitank platoon is entering our sector, vicinity of your light section: Engage on sight. Light section - lanes 3-4 engages: 2 saggers 1 BMP 1 moving BMP
9.	Platoon Leader your right flank element (light section) is continuing to receive the majority of the enemy ATTACK. Suspected enemy tank platoon with infantry engage on sight. Light section engages: 3 tanks 2 infantry squads
10.	Platoon Leader informed to displace one section (Lt) to B.P. arrow. a. Light section clear all weapons. b. Display green flag. c. Moves to arrow.

SCENARIO - TABLE IX
DAY - ARMOR

EVENT #	ACTION
11.	After giving the light section instructions inform Platton Leader that an antitank platoon has reportedly entered his section. Engage on sight. Heavy section engages: 1 sagger (lanes 1, 2, 3) 1 BMP 1 moving BMP
12.	Platoon Leader at least 2 platoons consisting of tanks, BMPs, and dismounted infantry are deploying in your sector. Engage on sight. Heavy section engages: 3 tanks 2 BMPs 3 infantry squads
13.	All clear - all clear. a. Gas masks removed. b. Heavy section told to: (1) clear all weapons (2) display green flag (3) move to arrow (4) light section should be set at ARROW.
14.	Both sections set at ARROW. a. Identify range fan marker. b. Display red flat. c. Load main gun (only).
15.	Platoon Leader intel indicates a threat tank platoon and several BMPs have entered your light sections sector. Engage on sight. 3 tanks 2 BMPs 1 moving BMP

SCENARIO - TABLE IX
DAY - ARMOR

EVENT #	ACTION
16.	Platoon Leader several enemy vehicles consisting of tanks and BMPs have entered your heavy section sector. Destroy: 2 tanks 2 BMPs 1 moving BMP
17.	Table IX completed. a. Clear weapons. b. Display green flag. c. Proceed to PL white. d. Drop AI off at PL white. e. Move to lane 6 and depart range. f. Report to AA for non-firing tasks.
18.	a. Firing platoon clears PL white. b. Next firing platoon moves from behind PL white to BP path. Immediately. c. Scorers follow next firing platoon down range and begin scoring targets (near to far). d. Far targets scored. AI boards tank at path scoring track returns to position at finder. Lane 6 collects score sheets and returns to maintenance tent.

SCENARIO - TABLE IX
NIGHT - ARMOR

EVENT #	ACTION
1.	Firing platoon occupies BP Path.
	a. Displays green light.
	b. At BP Path:
	(1) Identifies range fan markers - reports.
	(2) Performs safety/prep to fire checks.
2.	Permission to go WET granted:
	a. Displays red lights.
	b. Load NACCA - check fire.
	c. Reports when complete (10 minute limit).
3.	Receiving heavy pressure from two enemy tank companies to your front. Engage on sight.
	a. First NACCA engagement - 10 tanks (60 seconds).
	b. Second NACCA engagement - 5 tanks (60 seconds).
4.	Due to increased pressure on your front displace one section to BP Finder.
	a. Designated section clears NACCA's.
	b. Displays green light and moves out.
5.	Section on BP Path receiving pressure from approximately two tank platoons.
	Third NACCA engagement - 5 tanks (60 seconds).
6.	Section on BP Path clear weapons, displays green light, and displaces to BP Finder.
7.	Entire platoon is set on Finder:
	a. All elements identify range fan markers.
	b. All weapons loaded (except NACCA).
	c. Displays red lights.
	d. Platoon reports when ready.

SCENARIO - TABLE IX
NIGHT - ARMOR

EVENT #	ACTION
8.	Intel indicates that an antitank platoon supported by SAGGERS is moving into our sector. Engage on sight.

HEAVY SECTION	LIGHT SECTION
4 - BMP's Stationary	1 - BMP Stationary
1 - SAGGER	3 - Tanks Stationary
1 - BMP Moving	1 - SAGGER
	1 - BMP Moving

9. Elements identified as a tank company (-) supported by SAGGERS has entered your sector. Engage on sight.

HEAVY SECTION	LIGHT SECTION
3 - BMP's Stationary	2 - BMP's Stationary
3 - Tanks Stationary	3 - Tanks Stationary
	1 - SAGGER

10. Dismounted infantry supported by BMP's and HIND helicopters are reported to be moving into your sector. Engage on sight.

HEAVY SECTION	LIGHT SECTION
3 - Troop Targets	2 - Troop Targets
1 - BMP Moving	1 - BMP Moving
1 - HIND Stationary	1 - HIND Stationary

11. This completes your Table IX-B run.

a. Clear all weapons.

b. Display green light.

c. Move off course via Lane 6.

APPENDIX C

TANK CREW GUNNERY TRAINING QUESTIONNAIRE

TANK CREW GUNNERY TRAINING QUESTIONNAIRE

Duty Position _____ Tank _____
Rank _____ Company _____
Battalion _____

1. How many months have you been assigned to your present tank crew?
_____ months.

2. How long have you worked in your present duty position regardless of tank crew or company?
_____ years _____ months.

3. How long have you served in M60 tanks regardless of duty position?
_____ years _____ months.

4. When was the last time you fired Table VIII?
_____ months. _____ never fired Table VIII.

5. The last time you fired Table VIII, was it with your present tank crew?
_____ Yes. _____ No. _____ Never fired Table VIII.

The questions below relate only to the tank crew gunnery training that you received during the last month.

6. Do you think that the training you received over the last month or so will help you for your tank crew gunnery qualifications at Baumholder?

a. The training will help a lot_____.

b. The training will help a little _____.

c. The training will not make any difference _____.

d. The training will hinder my performance _____.

7. Do you think that the tasks you trained on involved the same kinds of skills that you will expect to use for your crew gunnery qualification tables?

a. Yes, the same type _____.

b. Some differences _____.

c. Many differences _____.

d. No, the skills are not the same _____.

TANK CREW GUNNERY TRAINING QUESTIONNAIRE (cont'd)

8. Did you have enough time to practice all of the tasks that you trained on?

   a. Enough time for all of the tasks _____.

   b. Enough time for some of the tasks _____.

   c. Not enough time on most of the tasks _____.

9. On what skill or task do you think you should receive more training?
   _____.

10. Did you receive a briefing or explanation for each task that you trained on so that you knew what you were supposed to do and why?

   a. On all of the tasks _____.

   b. On some of the tasks _____.

   c. On very few of the tasks _____.

   d. On none of the tasks _____.

11. Did you have any problems or failures with the equipment on your tank during training?

   a. A lot of problems _____.

   b. A few problems _____.

   c. No problems at all _____.

12. Did you have any problems or failures with the training equipment (Brewster device, Laser, targets) during training?

   a. A lot of problems _____.

   b. A few problems_____.

   c. No problems at all _____.

13. Below is a list of training tasks or exercises. Rank the three tasks that you think are <u>most important</u> for crew gunnery training. Put a 1 after the task or exercise that you think is <u>most important</u>. Put a 2 after the next most important. Put a 3 after the third most important. Remember to rank only the three most important.

a. Estimation of lead for moving targets _____

b. Adjusting fire on targets _____

c. Laying the main gun and aiming _____

d. Tracking moving targets _____

e. Range card data _____

f. Target acquisition and identification _____

g. Ranging on targets _____

h. Mini tank range subcaliber firing _____

i. Loading main gun _____

j. Immediate action on main gun and machine guns _____

k. Moving tank range-laser firing _____

l. Tactical driving _____

14. For the same list below, rank the three tasks that are <u>least important</u> for <u>tank gunnery training</u>. Put a 1 after the <u>least</u> important, a 2 after the next least important, and a 3 after the third least important. Remember to rank only the three <u>least</u> important.

a. Estimation of lead for moving targets _____

b. Adjusting fire on targets _____

c. Laying the main gun and aiming _____

d. Tracking moving targets _____

e. Range card data _____

f. Target acquisition and identification _____

g. Ranging on targets _____

h. Mini tank range subcaliber firing _____

i. Loading main gun _____

j. Immediate action on main gun and machine guns _____

k. Moving tank range-laser firing _____

l. Tactical driving _____

TANK CREW GUNNERY TRAINING QUESTIONNAIRE (cont'd)

15. Overall, do you think that you receive enough tank gunnery training at your local training area during the year?

a. Receive more than enough _____

b. Receive enough _____

c. Need more training _____

16. Overall, how well did you like the training you received in the last month?

a. Liked very much _____

b. Liked somewhat _____

c. Didn't like or dislike _____

d. Disliked somewhat _____

e. Disliked a lot _____